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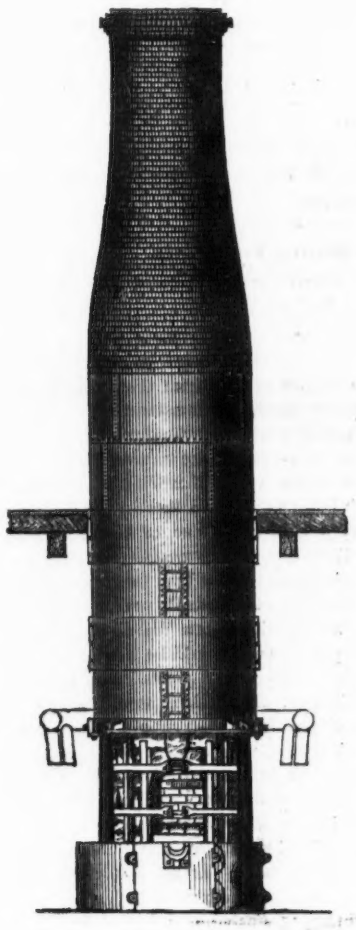


Fig. 1.

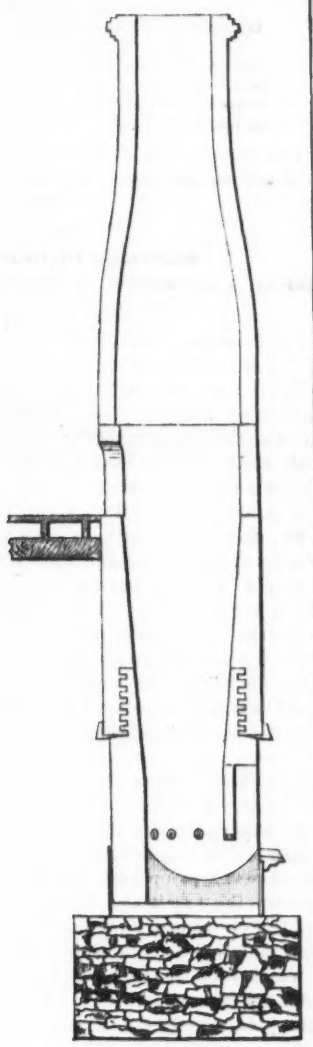


Fig. 3.

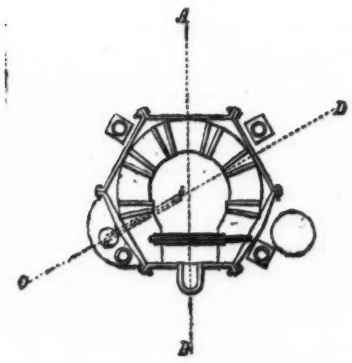


Fig. 2.

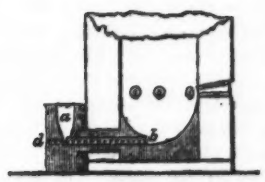


Fig. 4.

THE WINNAMUCK LEAD FURNACE

Economical Results of Smelting in Utah.

By ELLSWORTH DAGGETT,

Manager of the Winnamuck Smelting Works, Bingham Canyon, U. T.*

THE ore smelted in the Winnamuck furnace during the year 1872 consisted, for the most part, of oxydized ores from the Winnamuck mine, only sixty tons of outside ore (from the Spanish mine) having been smelted. The latter, like the principal Winnamuck ore, was oxydized or so-called carbonate ore. There was mixed with those oxydized ores three hundred to four hundred tons, or 7 to 10 per cent. of galena, some of which was mined with the oxydized ore, while a part was mined separately from the lower portion of the mine, and afterwards mixed with the ore, with a view of preventing the formation of deposits of metallic iron in the furnaces.

The average assay in silver of all the ore handled was 51.46 oz. per ton, most of it existing as chloride of silver. The lead contents were 34.98 per cent., all, or nearly all, in the form of carbonate of lead. The relative amount of silver is not at all constant, the best silver ore often being poorest in lead.

The predominant gangue was silica, several determinations of which have been made on representative samples, yielding in three such samples 26, 38 and 58 per cent. silica, the latter test being ore containing but little lead. The average contents in silica are about 35 per cent., with 6 to 7 per cent. sesqui-oxide of iron, and small quantities of alumina and lime. Mechanically, the ore was very fine, and so thoroughly disintegrated that it presented few distinguishing characteristics, rendering sorting or separating of ore from waste difficult, and often impracticable. Experiments on a small scale have been tried, with a view to separate the silica by washing; but these were unsuccessful, as the finest slime, requiring a long time to settle in still water, contained a large amount of silver; and on a careful sizing and washing of the sands and coarser parts, the silver contents were found to be less dependent upon specific gravity than is necessary for successful concentration. The lead contained admitted of a certain degree of concentration, but not the silver.

The fluxes used were iron ore, limestone and slag. The iron ore used is red hematite, from Rawlins, in Wyoming Territory. Three determinations of the iron ore yielded respectively 66.5, 67.46, and 68.5 per cent. of metallic iron. They were of different samples; the last of an average sample of a car load, or eleven tons. The little silica (3 per cent.) found in one analysis was probably due to dirt intermixed in transit, as the only observable gangue is calcspar, which may occasionally be found. The average may be taken at 67 per cent. iron, 2 per cent. carbonate of lime, and 1 per cent. dirt. The limestone used contained about 6 per cent. silica, and traces of magnesia.

The fuel was almost entirely charcoal, only a few tons of coke having been used near the end of December. Of the 311,996 bushels of charcoal used, 85,000 to 90,000 bushels, made from nut-pine or "piñon," was of good quality, though not equal to coal from hard wood, such as maple, hickory, etc. The remainder was from red and white pine, cedar and quaking-asp, which, however well burned, cannot make a good, or even fair, fuel, especially when compared with the Connellsville coke, lately introduced. It must be understood that this statement is made solely with reference to the comparative melting powers of the two kinds of fuel, and does not take into consideration the possible increased loss in lead and other precious metals, due to a much higher temperature, when coke is employed. The exact value of this latter element cannot yet be determined. With regard to the melting power, our work this year proves that one ton of Connellsville coke, weighed into the furnace, is rather more effective than two tons of the charcoal of the country, the cost of the two materials at Bingham being about the same, ton for ton.

In addition to the fact that the soft charcoal lacks in heating power under the most favorable circumstances, there is connected with its use much waste, especially where, as in Bingham Canyon, it must be transported by rail and team for a long distance, and (as is often the case) paid for at some distant point.

The amount of material smelted during the year 1872, was as follows:

Material.	Tons.	Per cent. of Ore.
Ore	3954.913	100 00
Iron ore	1391.681	35.19

* A paper, read before the American Institute of Mining Engineers, Philadelphia, May 21, 1873; constituting, also, a chapter in the report of the U. S. Commissioner of Mining Statistics, rendered February, 1873, and not yet printed.

Limestone	1542.021	38.99
Slag	639.339	16.16

The slag obtained contained from 35 to 48.7 per cent. silica. The average of four analyses showed 42 per cent.; but as these analyses were mostly of unusually stiff slag, their average is too high.

The only complete analysis of slag at hand is of a sample produced from a smelting mixture containing rather more limestone and less iron ore than usual. The analysis, made at the Sheffield Scientific School of Yale College, under the direction of Prof. G. J. BRUSH, is as follows:

Silica	37.93
Sulphide of lead	3.75
Sulphide of iron	0.44
Alumina	2.00
Protoxide of iron	30.76
Lime	23.62
Magnesia	0.57
Total	99.07

Although the data are not yet as complete as could be desired, we may approximately calculate the average slag analysis. The ore contained by fire-assay about 35 per cent. of lead. Allowing the loss in the fire-assay to be 2 units, we have as actual lead contents 37 per cent., equivalent to—

Carbonate of lead	47.7
Silica*	35.0
Sesqui-oxide of iron*	6.9
Other bases not determined—Alumina, lime, etc., and sulphur	10.4
Total	100.0

Hence we have as slag-constituting element in ore and fluxes (except the slag charged, which, being neutral, may be omitted):

	Silica.	Protoxide of iron.	Lime.	Other substances
In 100 parts ore	35.0	6.2		10.4
" 35 " iron ore		30.2		
" 39 " limestone	2.3		20.5	
Total	37.3	36.4	20.5	10.4

Parts in 100:

Silica	35.6
Protoxide of iron	34.8
Lime	19.6
Other bases: Alumina, oxide of lead and magnesia, with sulphides of lead and zinc	10.0
Total	100.0

As will appear below, one of the difficulties encountered in smelting has been the rapid burning out of the furnace material; and the question has frequently been asked, why not use less flux, to produce a more highly silicated slag, and save the furnace material of the furnace? The answer to this is, that, with the poor fuel in use, a reduction of the quantity of the basic fluxes used caused the smelting to proceed too slowly; so that the increased cost of labor and general expenses per ton of ore more than counterbalanced the saving in flux and furnace material. Indeed, our experience indicates that, with the soft charcoal as fuel, when producing slag containing over 36 per cent. in silica, the consumption of the furnace material is not materially decreased by increasing the silica contents of the slag. This may be explained as follows. The capacity of a slag to dissolve furnace material (chiefly silica) depends directly on the temperature and inversely on the amount of silica already contained in the slag. Now, in general, any increase in the silica contents of a slag of this description necessitates an increase of temperature; and, so far as can be determined in the crude operations of a blast furnace, the new conditions counterbalance one another.

By slags much more basic than the above, the furnace material is more rapidly destroyed.

The furnaces of the Winnamuck Company are two in number, and in dimensions (except height) follow the plan of the first Pilz furnace, erected at the Eureka Consolidated Works in Nevada by C. VON LIEBENAU in the year 1870. There are, however, some essential points of difference in the construction.

In the accompanying sketch, fig. 1 is a front elevation of the furnace, showing the columns and their attachment to the flange; fig. 2, a horizontal section through the tuyeres; fig. 3, a vertical section through the line AB in fig. 2; and fig. 4, a vertical section through the line CD in fig. 2, showing the lead well and siphon tap. In fig. 1 the lower part of the furnace is shown, built of stones, which, when properly seasoned, is as lasting as firebrick. In the section, the upper part is common brick; the next below, fire brick or stone (usually brick) and the dotted lines, a layer of clay six inches in thickness, tamped on to the foundation. The latter, with the plates, should render it impossible for lead to escape into the foundation.

The bottom is made of a mixture of ground clay, raw, and sand or ground fire brick, just sufficiently damp to pack well, and is secured or repaired at the end of every run.

The "siphon tap," as used in the Winnamuck furnace, is shown in fig. 4. There is left in the center of each side plate a round hole, 12 inches in diameter. On whichever side it is desired to have the tap, a piece of ¼ in. sheet-iron, of the width of the plate (3 feet) and about 5 feet long, is bent in the form shown in fig. 2, and firmly fastened to the plates at the corners. The space thus enclosed and the channel *c*, connecting it with the inside of the furnace, are now tamped full of a mixture of sand and clay, during which process a round piece of wood 2½ or three inches in diameter and 3½ feet long, having through its center a ¾ in. auger-hole, is enclosed, in the position shown at *c b*, fig. 4. The lead well itself (*a*, figs. 2 and 4) is cut out to the size and shape shown.

To provide for any impediments in the passage *a*, Fig. 4, at any time during a run, there is at *d* a small hole in the sheet-iron casing, through which a bar may be driven to the inside of the furnace, and which afterwards may be stopped with a plug of clay, thus forcing the lead up into the well. This siphon-tap is a great improvement on the old method, and MESSRS. ARENTS & KEYES, of Eureka, deserve and have the thanks of all smelters for its introduction.

DIMENSIONS OF FURNACE.

	ft.	in.
Height of plate from foundation	3	0
" columns from foundation	8	0
" feed-hole "	17	9
" tuyeres "	3	8
Diameter of furnace at tuyeres	3	6
" " feed-hole	5	3
" " top of chimney	3	6
Height of tuyere-nozzles above slag-flow	10 to 11	
" " top of plates	7 to 8	
" water-tymp-iron above slag-flow	7 to 8	
Diameter of columns at base		8
" " top		6
Thickness of the iron of the columns		½
Number of tuyeres	6 or 7	
Diameter of nozzle		2½
Height of tuyeres above bottom	2	3

That portion of the furnace above the flange, to the feeding-flow, is cased in ⅛ in. sheet-iron, and above this, for a height of six feet, in thinner sheet-iron.

TO BE CONTINUED.

*Determined by analysis of general samples.

American Institute of Mining Engineers.

REPORT OF PROCEEDINGS OF THE PHILADELPHIA MEETING, WEDNESDAY, MAY 21.

(*Continued from page 372, Vol. XV.*)

The PRESIDENT—I would like to ask if there are any collieries in which a process of extraction, accompanied by a "backing" of slate, would be practicable.

Mr. HARDEN—Do you mean by that, the sending of stuff from the surface? If so, however well it may have answered under special circumstances in a thin bituminous seam, it could not be made to pay in working anthracite.

Mr. COXE—I understand from Mr. HARDEN that where there was 24 feet of coal, with thin beds of intervening slate; they work the whole of it by the Longwall system, losing, practically, only that which becomes fine and thereby unsaleable.

Mr. HARDEN (referring to the map of a colliery of one of the Midland counties of England in which the Longwall system is universal)—this section, looking as if it were but one seam, is in reality made up of five, four of which, 22 feet, are mined out. In the earlier days of this colliery shafts were put down on the rise side, from the bottom of which a hill (slope) was driven in one of the divisions to the deep, from whence an opening head would be driven to the width intended to be worked, generally from 100 to 200 yards. The miners would then undermine the coal, each to his stint, when others would wedge it down; it would then be run out in "dans" (small sleighs) such as lads could drag along the face, to a larger car at the hill side, whence it would be hauled to the bottom of the shaft by a drum arrangement in connection with the hoisting engine. If after holing the coal was left standing two or three hours, it would materially assist the wedging; if left longer, it would weight itself down. Holing after holing, taking out all the coal, retreating and leaving the roof to fall behind, was kept up until the shaft was neared, when another hill would be driven to the deep in another division of the seam and the process repeated. The dark tint on the map represents the ground thus exhausted, and from which the ironstone has since been extracted by the same shafts. As the demand for coal increased, it became necessary to devise some more extended means of production, and it was deemed unnecessary to put down a slope from the shaft in each of the seams. In one case the slope was driven in one of the lower seams—the Ell coal—and on nearing the boundary, a distance of 2700 feet, the measures were crossed to the uppermost seam which, being opened out, and mined a distance ahead, the second seam was opened, the gob of the first being kept up by a thin coal and intervening slate; the coal from both seams was run to the same slope. In this way operations were conducted on each side of it at once; the coal being run from the face by jigger roads to the crossgates or gangways, from thence to the slope, after the method of Longwall advancing, a good broad pillar being left over the slope to protect it, this being mined out as the work advanced. The jigger roads and crossgates were built up of timber, the refuse of the coal and fallings of the roof. The same slope answered also for the coal it was driven in; three seams therefore were brought out by this one slope; but for the lower coal a second slope was driven in the bottom of the seam. The face openings also were driven away on the same level, and had the upper portion of the seam, with its attendant slate, for a roof, which upper portion, however, was being gotten in the waste. In other words, not lost; falling behind the prop timbers as the face advanced, it was taken out of the gob and sent with the other coal along the face. With a long slope it is not necessary, as some have suggested, to withhold mining coal for the market until the boundary is reached. As shown on the map, at a thousand feet from the shaft, a gangway was driven out, with a good pillar left next the slope and mining after the manner described was carried on, while the driving of the slope was con-

tinued. In another case, with 3000 feet breadth of area in the deep of the shaft, there was also ten acres on the side to the rise of it. Here openings were made, of course with care for the shaft, and the coal worked, while a pair of diverging slopes were driven to the deep.

Mr. COXE—This is a case in which it was a big vein, worked in three lifts by the Longwall system, with comparatively little loss. The distance between the two upper coals is one, two, or three feet of slate, which, as I understand it, is very much like many of our veins in the anthracite region. But the objection to the Longwall system, in our minds, has been, that this roof would come down on working the coal below it, and that the system is one of those that, as our President has already said with reference to another subject, you cannot bring to this country in a box. It must be modified, adapted to our wages, and the interest value of money in this country; that is an important element. In foreign countries they get four, five and six per cent. for money, whereas we here want fifteen or twenty per cent. It seems to me, therefore, that this Longwall system, looking at it theoretically, might not be the best under the existing circumstances, and it is important that we should discuss it and have a full description of its workings. Hence my reason for opening the subject and asking Mr. HARDEN to describe the system, as exhibited on his maps.

Mr. FIRMSTONE—At what angle were the levels driven?

Mr. HARDEN—The measures vary in "dip" from 1 in 3½ to 1 in 4½, or from an angle of 12° to that of 16°. Where the slope is driven plumb-dip, as in "this" case, the levels or gangways would be set away necessarily at a right angle; but where the slope was driven "half end and half face" the angle at which the levels were driven would vary accordingly.

Mr. COXE—In our colliery the bottom bench runs 5 or 6 feet; then we have 2 feet of hard black slate, partially coal, and sometimes 8 or 9 feet of coal over it. The trouble is, the top rock is as hard as flint; so we build walls up entirely from the floor, and the roof, instead of bending down, would simply go on until it gets such a pressure that it comes down in one body.

Mr. HARDEN—With the seam as you describe it, unless the coal parts freely from the slate, I hardly see how you are to mine it in separate benches. Certainly the slate would be of no service as a roof. If so mined, I judge, you would take the uppermost bench first. The slate adhering to the coal and being itself, as you say, partially coal, would not separate, but come down on mining the lowermost. But I do not think Longwall would assist you even with a free parting slate; a modification of it might; but the roof being unyielding, no reasonable amount of gobbing would prevent the wholesale movement of which you speak; at the same time, with a tolerable uniformity in the lay of the seam, it might be possible, between intervening pillars, to mine out the coal in longer banks, or, if you please to call them so, wider chambers. But this, it seems to me, if done at all, must be done "retreating."

Mr. COXE—The trouble is, that you cannot tell when the roof will come. It may stand for a year, and it may not—you don't know.

Mr. HARDEN—Five or six years ago, the Longwall system, as applying to anthracite mining, was made the subject of controversy at Wilkesbarre, and I have since seen no reason to alter my views then expressed—namely: That the heavy and unyielding nature of the roof, of which you complain, the locally disturbed condition of the level of the seams generally, together with the consequent irregular diffusion of the weight brought on in the mining, are conditions the reverse of those necessary to success; while in the bituminous region there are places in which it might be adopted with advantage.

A communication from Dr. T. STERRY HUNT on the Geology of the North Shore of Lake Superior was then read in absence of the author by the President. This paper is published on another page.

The President read a paper on the Calorific Value of the Western Lignites, which has already appeared in our columns.

Prof. PRIME, of Easton, then explained the construction of the Büttgenbach Blast Furnace, with the aid of a large drawing. Prof. PRIME, (explaining the drawing):

The peculiarity of the Büttgenbach furnace consists in the shaft having only the inner lining, the outer wall being done away with. This shaft is supported on a crown-ring resting on seven pillars connected by arches. At the junction of the shaft and boshes water-boxes are placed. The shaft is only 18 inches thick. The plan of supporting the platform at the furnace top, and of the down casts, is unique. The down cast pipes being made of wrought iron and supporting the platform. The advantage claimed for this arrangement is that the whole of the furnace-shaft may be removed if necessary, and that owing to the thin walls less fuel is consumed. While many persons, TUNNER among others, have thought that the loss of heat would be enormous in a furnace of this construction, JORDAN has found this not to be the case. BÜTTGENBACH states that of two furnaces at the Neuss works, one of this and one of the old construction, the latter consumes 10-15 per cent. more fuel than the former. The advantages claimed for this method of construction are easy accessibility to all parts of the furnace, greater duration of the same, and a decreased cost of construction. The first furnace was built at Neuss in 1867, is 53 feet high, 16 feet diameter at top of the boshes, and where these join the shaft the water boxes have been placed. The Neuss furnace has been damped down on several occasions for two or three weeks, and once, during the Franco-Prussian war, owing to the lack of coal, for ten weeks; but on every such occasion it has taken up its regular work again in the course of two or three days after the blast had been again turned on. BÜTTGENBACH says that the reduction is retarded by the increase in the slag-forming matter and in proportion as the temperature is increased above a cherry-red heat, because the increase of temperature favors the vitrification of the slag-forming matter, which hinders the reducing gases from penetrating the ore. If the temperature in the upper part of the boshes exceeds a certain height the ores commence to vitrify and the gases ascending from the lower part and which, in presence of superfluous carbon, are always recarburised, will pass through the mass of the vitrified ores, without effecting sufficient reduction. Therefore this has to take place at the expense of the carbon that comes into contact with the ores, which occasions a waste of fuel. Besides the furnace at Neuss there are two at the Usines d'Anzin, near Valenciennes, two at Givors-Isère, near Lyons, two at Harel & Co.'s works, near Lyons, two at St. Louis, near Marseilles, one being built at St. Dizier and one at Wasy, Haute Marne, all in France. In Austria there are three at Inneberg, near Vienna, and one at Putten. The furnaces at Anzin smelt oolitic ores; those at St. Louis, magnetic ores for making Bessemer pig. Harel & Co. are smelting Spanish ores; at Neuss, Büttgenbach is smelting a mixture of brown and red hematites. There is very little more to be said. The matter is brought up for discussion before the Institute. Almost every thing about the furnace has already been stated in the ENGINEERING AND MINING JOURNAL of last Fall. The peculiarity, of course, is in its construction.

Mr. WM. FIRMSTONE—These furnaces don't all work the same quality of ore?

Prof. PRIME—No. It seems to me, however, that the production of this furnace is high—for a furnace of that capacity, 53 feet high.

Mr. WM. FIRMSTONE—Many years ago they made that kind of furnace; but in comparing it with a thicker wall furnace, it always took more coal than the thicker wall. One reason may have been that it was smaller, and of course of less capacity. That may have been the reason, and not the thinness or thickness of the wall.

Prof. PRIME—One thing BÜTTGENBACH claims, is that 25 per cent. is saved in the construction of the furnace. Still, if it is certain that the Büttgenbach furnace takes more coal than the thick wall furnace, then the thick wall can very well afford the extra expense.

Mr. F. FIRMSTONE—A great deal is said about thick wall and thin wall furnaces; and very properly. At the Dowlais Works, TRURAN states, they had four blast furnaces, with their internal arrangement exactly similar, going side by side in the same ores. Two of them were the old fashioned furnaces, with thick walls, and they invariably used more coal than the thin wall furnaces. They tore down those furnaces. That is the only thing I have found direct to the point.

Prof. PRIME—The only question is—has BÜTTGENBACH said what is true or false? If he can make a pound of iron by using a pound to a pound and a tenth of coke, then he does as well as any other can do.

Mr. WM. FIRMSTONE—That is all we have got to abide by—what BÜTTGENBACH has said. But the question is—if he can do that with his furnace, what could he do with a thick wall? The amount of fuel used in a blast furnace is so large, that a small saving will pay the interest in a great deal of money.

(TO BE CONTINUED.)

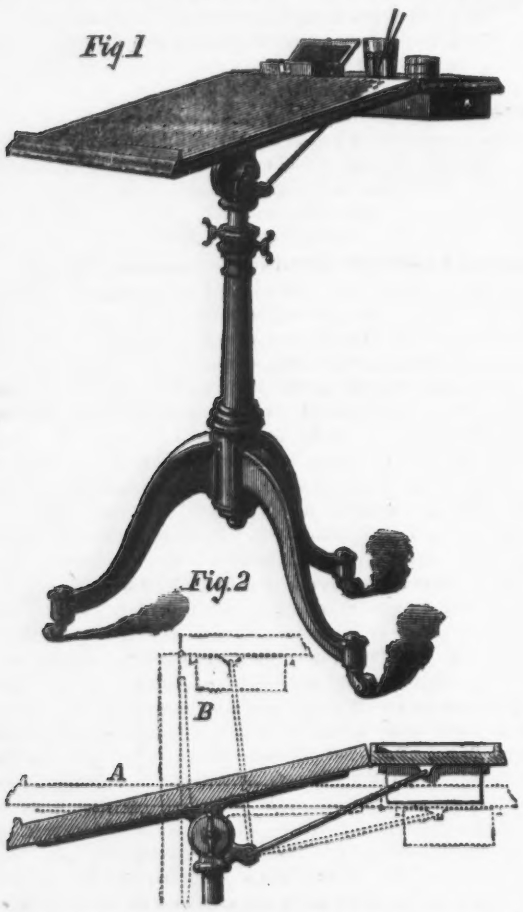
Dynamite Explosive Agent in its Sanitary Aspect.

FOR a considerable number of years the fact had been recognized that the occupation of mining is much less satisfactory from a sanitary point of view than other forms of outdoor work. The genuine miner has not only his fair proportion of trivial diseases, but in addition suffers from various affections of the respiratory organs, which almost double his mortality when compared with the non-mining population of the neighborhood. The causes of this excessive mortality are imperfect ventilation, candle smoke, powder smoke, and in dry mines dust from boring and pickwork. Dr. ANGUS SMITH had established the injurious influence of gunpowder on the health of miners. Since dynamite had been introduced in the Cornish mines accidents had been more frequent. This, however, was to be expected; some little experience was required in the method of employing it before agents could give, with confidence, the necessary instructions. There was a marked difference between a dynamite accident and one in which gunpowder had been explosive, arising from the extraordinary force with which the dynamite acts. If an eye be injured the chances were greatly in favor of the globe being penetrated. If a flesh wound, the parts do not present the blackened charred mass so frequently seen with gunpowder, but the skin is speckled with pieces of the cap or surrounding mineral, which occasionally lodge to the depth of an inch, and the edges of the wound are in some cases regular and even as if cut with a bluntish knife. Temporary deafness from concussion was not uncommon. In practice they found that when complete explosive decomposition of dynamite took place it originated no very unpleasant effect. It was, however, rare that complete decomposition occurred, for miners would overcharge the hole. Miners who employed dynamite complained of headache, and of affections of the mouth, eyes, larynx, throat, and lungs, indicative of the inhalation of some irritating vapor, but a great many diseases were attributed to dynamite, when, on careful inquiry, there could not be discovered a trace of connection. Acrolein, or ærlic aldehyde, he believed to be the head and front of the offending, and Dr. GLADSTONE and Mr. Bottomley had suggested that the wearing of respirators made of caustic potash, which could be made for a few pence, would make the ærolein uninjurious. From the Registrar-General's returns, and the admirable tables compiled therefrom by Mr. R. BLEE, there was no doubt that the Cornish miner was shorter-lived than either his agricultural neighbors or his fellow-miner in the North of England, and the increased mortality between the ages of 40 and 60 years was due to affections of the respiratory organs. Much had

been written on miners' asthma and miners' consumption, and it was unquestionable that tubercular disease existed in some cases, but in by far the larger proportion the symptons presented were not only not those of tubercle, but were similar to those presented by flax dressers, knife grinders, stone polishers, and others who worked at dusty occupations. In all, particles of solid matter entered the lungs, set up irritation mechanically, and excited chronic inflammation, when either by hereditary or acquired debility retrogressive molecular changes preponderated over the progressive. Blasting powder contributed in no small degree to the solid constituents of the air of mines, and he was therefore disposed to believe that gun cotton and preparations of nitro-glycerine were in that respect its superiors, and by the use of one or the other the frequency of cases of miners' asthma was likely to be diminished. An incalculable amount of good had been done to the miners of Camborne, Illogan, and Redruth by the unparalleled generosity of Lord Robartes in building and maintaining the miners' convalescent hospital, where the acquirement of this debilitated state in the life of the individual is warded off by good food, rest, and judicious treatment. Feeling deeply interested in the medical aspect of dynamite, and finding that imagination had assigned to it almost every case of disease that came before him, he resolved to go underground, inhale the gases resulting from the explosive decomposition, and judge for himself. Captain RICH, of Wheal Uny, gave him every facility, and he was surprised at the care taken both at Wheal Uny and East Pool for the health of the men employed underground. Currents of air circulated freely, save in a few ends where it was unavoidable, and the workings were carefully timbered so as to prevent accidents. Mr. ROWE, chemist, who accompanied him underground, had supplied him with chemical notes relative to these explosive agents. These notes were of considerable length, and gave the various chemical products of gunpowder, dynamite, gun cotton, &c., and the result was in favor of the use of dynamite.—*Read by Dr. Hudson, before the Royal Institution of Cornwall, Wales.*

An Adjustable Drawing Stand.

We illustrate in the accompanying cut a very convenient drawing table made by the Washburn Machine shop, connected with the Free Institute of Industrial Science, in Worcester, Mass. As the drawing plainly shows, the table is supported on a tripod, in the shaft of which slides the supporting bar of the table. This permits the height to be adjusted at will, while the inclination of the table is equally under control. A paint box and instrument shelf is placed at the upper



edge of the table, and in some styles two drawers are added to it. The simple expedient of connecting this shelf, by a rod, with the supporting bar keeps it always in the horizontal position, whatever the angle of the table itself may be. Solidity is attained by making the stand of cast iron. These tables besides being a very compact and ingenious arrangement of the fittings a draughtsman requires, are particularly well adapted to those persons who want to have the conveniences for drawing always at hand, without giving up a room to the necessary tables. These stands are neat in appearance, can be placed in any room and are always ready for use. In the vertical position the table makes an excellent easel, and an attachment for holding a picture, not shown in the cut, is sent with it. These tables which are certainly very handy and serviceable may be obtained of Mr. M. P. HIGGINS, Superintendent of the Washburn Machine Shop, Worcester, Mass.

It is an additional recommendation of this stand, that it is the invention of students in the Worcester County Free Institute of Science. Made for use and not to sell, it has the real advantages and convenience which should mark such a production. The institution with which they are connected is an interesting subject of study, and belongs to a much needed class of schools. Mr. COLEMAN SELLERS, President of the Franklin Institute, lately described the Worcester institution before that society, and we take the following extract from his remarks.

This school was founded by one JOHN BOYNTON, in the year 1865. To his gift of one hundred thousand dollars, other liberal citizens added various sums, until a school was established on a firm basis. In the year 1866, the Hon. ICHABOD WASHBURN conceived the idea of adding "a machine shop of sufficient capacity to employ twenty or more apprentices, with a suitable number of practical teachers and workmen in the shop to instruct such apprentices, and provided with all necessary steam-power, engines, tools, apparatus and machinery, of the most improved models and styles in use, to carry on the business of such machine shop in all its parts as a practical working establishment," his wish being that the apprentices entered should have as good a chance to become proficient workmen as if brought up in any of the best workshops, with the addition of some mental training. In the deed of gift Mr. WASHBURN made the wise provision, that in the event of any insurmountable difficulties arising in carrying out the plans, the money might be merged into the general fund of the Institute. So far as I have been able to learn, the design of the school is, in its scope and purpose, much like the technical schools of Europe, giving prominence to the practical element. It is not my intention this evening to review the entire course of practice and studies, but rather to draw your attention to what I have learned in regard to the management of these apprentices. The managers of the school, knowing the interest I have taken in the subject of the education of mechanics, have given me much information regarding the theory of its operation.

It seems that a five months' trial is deemed sufficient to demonstrate the fitness of any student to pursue the mechanical career; if he shows too little mechanical talent, his true bent may be discovered, and he is then transferred to such department as may best fit him for active life; so that the non-mechanics become weeded out, and those who continue are the more careful. The boys are advanced as rapidly as possible, and are freed from drudgery as soon as practicable. They are taught habits of industry, and made to feel the dignity of labor. Free-hand drawing is an imperative necessity. Mr. CHAS. H. MORGAN, in a letter under date March 10th, 1873, says:

"Regarding our school, I may say that it is successful in its attempt to combine theory and practice, especially in the department of mechanics. The students in this department are required to have five months' (solid) practice, except ten hours each week devoted to free-hand drawing before commencing studies. We have at present fifty-six boys in the shop and only six journeymen. You will certainly question how we manage so many boys, and we found it no easy problem. In answer, I have to say that we have found it for their advantage and to the success of our shop, to employ them at wood-work for the first year, in making small articles that require but little material; the time is well spent, and we gauge their capacity at the least expensive work, and we find that boys make quite as much advancement in working iron during the term for having had this practice in the wood shop. The drawing table is the work of students; they also make models for drawing. The senior class work on the speed and engine lathes." The machine tools turned out by the students are said to be well made. The boys entering the shop find workmen employed producing work for sale; they are employed at such parts as they can do to the best advantage, and their work is sold, but they receive no wages. Mr. WASHBURN did not believe such a shop could be made self-supporting, and he provided for this contingency by the interest of a fund of $50,000.

"With all these advantages the work done by the apprentices is hardly an adequate compensation for the expense involved in instruction, I understand that the object of the superintendent is to maintain the highest standard of workmanship practicable, and as the aim is to teach, not to make money, it becomes possible, by judicious management, to employ usefully nine apprentices to one journeyman.

The business of the shop amounts to about ten thousand dollars annually. The profits, with the income of the endowment fund, have so far just equalled the expense of operating it. It is claimed that the element of personal responsibility enters with every student's work, and all mere turning of material from one form into another for the sake of observing the process, is avoided. Two classes have been carried through the three years' course, and are successful as journeymen and as draftsmen in first-class machine shops. Students intending to take the course of mechanical engineering must begin their apprentice course five months sooner than any other class of students, and these five months are sufficient to enable the superintendent to determine the fitness of the student for the profession, and then, in case they have no aptitude for mechanics, they can enter the full term as civil engineers, or in architecture, drawing and design; in chemistry, or in English, French and German, certain studies being common to all these departments, as it is the aim of the institution to give as complete a general education as possible, and to point out the true relations of theory and practice. The course of study covers three years—senior, middle and junior.

THE COAL TRADE.

NEW YORK, June 26, 1873.

The results of the Auction Sale, as made up by Mr. JOHN MOORE, Room 74, Trinity Building, were as follows:

	June.	July.	Advanced.
5,000 Lump	$4.31	$4.43	12c.
7,500 Steamer	4.44	4.55½	11½
26,000 Broken	4.62	4.75	13
8,000 Egg	4.83	5.02	19
34,000 Stove	5.17½	5 26	8½
13,000 Chestnut	4.44	4.59	15
93,500 Average	4.75½	4.90½	15

The sale was quite lively and there is generally a better feeling among dealers. A sound and increasing, though slowly developing demand has been the characteristic of the market for weeks past, and this has now reached a point which sets the trade more at ease. The evidently fixed determination of the great companies to carry out their scheme has at length come to be understood. Now the only uneasiness that is exhibited is that buyers may take some sudden alarm and make calls that will lead some dealers into operating for excessive rates. It is no secret that a very sharp demand might tax the powers of producers so far as to give an opportunity for speculators. The trade generally seems to desire steady and fair prices, and to dread the chances of speculation, and if the latter class of dealers can rule the market, we shall see prosperity remain with the coal trade with a steadiness unknown to it.

The men employed in the Newport mine of the Lehigh Coal and Navigation Company, have struck for higher wages. Hitherto they have received the same rate as the men employed by the Wilkesbarre Company, who are working under a contract. If the demands of the former are conceded, the Wilkesbarre people may have trouble to hold their men to the terms agreed on, and the Lehigh Company are determined not to yield. The strike bids fair to last a month or so. Another small strike among the shovellers of the same company at Mauch Chunk is of no moment. The company, we believe, have no intention of yielding.

Bituminous.

The market continues quiet with prices firm. An attempted demonstration in favor of a strike by the operatives of Pittsburgh, promised to unsettle the production of that part of the field enough to give some local activity to prices. But the demonstration was not a great success, the procession being made up of 2000 instead of 10,000 men as expected, and as the papers are exposing the politicians who are behind the movement, it is likely to lose its force as a genuine labor agitation. We cannot ourselves understand how coal miners can hope to better themselves by striking at this time, and doubt very much the success of any attempt to take out men over any large district.

Anthracite Coal Trade for 1872 and 1873.

The following table exhibits the quantity of Anthracite Coal passing over the following routes of transportation for the week ending June 21, 1873, compared with the week ending June 22, 1872.

COMPANIES.	1872. WEEK.	1872. TOTAL.	1873. WEEK.	1873. TOTAL.
*Phila & Reading R.R†..	114,437	2,154 519	115,909	2,375,754
*Schuylkill Canal	27,633	3,0,174	20 661	249,032
*Lehigh Valley R. R.	58,608	1,656,055	70,935	1,670,316
Lehigh & Sus. R. R.	31,175	765,408	35.201	908.819
" " Canal	2,144	243,549	25,667	232,490
Scranton North	15,429	311,253	20,616	351,892
" South	40,687	1,024,406	47,794	1,088,452
Penn. Coal Co., rail	24,889	545,373	30,599	530,100
" " canal	121	1,548	119	2,720
Del. & Hud C. Co. Canal	47,760	437,771	45,923	463,739
" " East	11,364	314,842	9,955	185,615
" " West	7,944	167,663	11,311	215,202
" " South	6 783	109,029	1.001	124,394
Shamokin	13,256	231,768	13 418	261,157
Trevorton	...	....	....	....
Lykens Valley Coal Co.	....	....	....	....
Wyoming North	10,126	308,341	14,487	344,184
Wyoming South	....	....	....	....
P. N. Y. C. & R. R. Co.	....	....	....	....
Williamstown Col'y	....	....	....	....
Big Lick Col	....	....	....	....
Total	439,254	8,651,272	492,946	9,003,874
1872			439,254	8.651,272
Increase			23,69:	352,672
Decrease				

These figures are for the week and fiscal period commencing Nov. 30.

† Less coal transported for Company's use and Bituminous coal.

Pennsylvania Coal Company.

Shipments of Pittston Coal for the week ending June 21, 1873.

	1873. WEEK.	1873. YEAR.	1872. WEEK.	1872. YEAR.
By Railway	30,598 15	530,100 00	24,889 05	545,372 13
" Canal	119 03	2,720 09	119 03	1,548 06
	30,717 18	532,820 09	25,008 08	546,920 19
Decrease, 1873	14,100 10			

Bituminous Coal Trade, 1872 and 1873.

The following table exhibits the quantity of Bituminous Coal passing over the following routes of Transportation for the week ending June 21, 1873, compared with week ending June 22, 1872.

COMPANIES.	1872. Week.	1872. Year.	1873. Week.	1873. Year.
C. & O. Canal	20,141	251,046	22,982	241,779
B. & O. R. R.	26,247	575,776	28,·8·	646,801
Penn. S. Line	....	.....	1,296	41,136
H. & B. T. R. R.	6,998	138.238	',492	211,·71
*Harrisburg & D.	8,6·3	249,261	6,·35	172,704
*L. V. R. R.	316	15,146	136	14,902
P. & N.Y.C. & R. Co.	8,921	184,777	6,930	157,081
{Cumberl'd Branch Canal	6,198	80,438	4,243	37,706
" Railroad	510	7,967	1,842	54,525
Total	78,284	1,502,649	80,543	1,578,495
	....		78,284	1,502,649
Decrease	....		2 258	
Increase				75,846

Philadelphia & Reading Railroad and Branches.

COAL TONNAGE

For the Week ending Saturday, June 21, 1873.

BY RAILROAD.—ANTHRACITE.

PASSING OVER MAIN LINE AND LEB. VAL. BRANCH.

	Tons.	Cwt.
From St. Clair	29,766 03	
" Port Carbon	4,781 11	
" Pottsville	1,793 18	
" Schuylkill Haven	31,534 18	
" Pine Grove	6,464 .8	
" Tamaqua	13,402 01	
" Harrisburg	16 15	
" Dauphin	6 389 18	
Total	94,679 12	

FOR SHIPMENT BY CANAL.

Passing Frackville Scales	3,290 05	
" Mill Creek "	2,122 16	
" Schuylkill Valley Scales	706 04	
" Mt. Carbon "	1,039 01	
" Cressona "	8,683 12	
" Pine Grove "	468 18	
" Tamaqua "	1,176 05	
Total	22,785 14	

SHIPPED WESTWARD VIA CATAWISSA AND WILLIAMSPORT BRANCH AND NORTHERN CENTRAL RAILROAD.

Via Catawissa & Williamsport Br.	127 08	
" N. C. R. R. passing Locust Gap	1,597 10	
" " " Shamokin	3,329 11	
" " " Herndon	....	
Total	5,051 09	

SHIPPED WEST OR SOUTH FROM PINE GROVE.

Via Schuylkill & Susquehanna R. R.	1,720 09	
" Lebanon & Pine Grove Branch	879 03	
Total	2,599 12	

CONSUMED ON LATERALS.

From Frackville Scales	427 00	
" Mill Creek "	255 01	
" Schuylkill Valley Scales	231 19	
" Mt. Carbon "	832 09	
" Cressona "	253 12	
" Pine Grove "	14 11	
" Tamaqua "	543 05	
Total	3,157 17	

LEHIGH AND WYOMING COAL.

Received via Silverbrook Junction, Sent East	6,620 05	
Cat. & Wpt. Br. Sent West	....	
" " Rupert, Cat. & Wpt. Br.	35 06	
" " Allentown, E. Penn'a Br.	44 01	
" " Alburtis, "	32 01	
" " Oreland, G. & N. Br.	881 07	
" " Willow Street R. R.	705 00	
Total	10,317 19	

BITUMINOUS.

From Harrisburg	6,884 11	
" Connecting R. R., G. & N. Br.	....	
" Junction R. R.	50 00	
Total	6,934 11	

COAL FOR COMPANY'S USE.

Anthracite	7,373 06	
Bituminous	196 09	
Total	7,569 15	

RECAPITULATION.

	Total for Week.	Corresp'g week last year.	Increase and Decrease.
Passing over Main Line and Leh. Val. Branch	94,679 12	100 016 18	d 5,337 06
For Shipment by Canal	22,755 14	26,687 00	d 3,931 15
Shipped Westward via Northern Central R. R.	5,054 09	7,740 06	d 2,685 17
Shipped West or South from Pine Grove	2,599 12	2,502 14	i 96 18
Consumed on Laterals	3,157 17	2,671 15	i 484 02
Lehigh and Wyoming Coal	10,317 19	1 502 12	i 8,8·5 07
Total Anthracite paying freig't	139,565 03	141,123 14	d 2,558 11
Bituminous	6,934 11	8,655 04	d 1,718 11
Total of all kinds paying freig't	145,499 14	149,778 18	d 4,277 02
Coal for Company's use	7,569 15	6 915 06	i 654 09
Total Tonnage for Week	153,069 09	156,442 02	d 3,422 13
Previously this year	2909276 05	2816012 09	i 84,263 16
Total to date	3062295 14	2972454 11	i 80,841 03
SHIPPED BY CANAL.			
From Schuylkill Haven	18,891 00	23 456 00	d 4,565 00
" Port Clinton	1,770 00	1,420 00	i 350 00
Total Tonnage per Week	20,661 00	24,876 00	d 4,215 00
Previously this year	228,371 10	298,3·3 09	d 70,951 19
Total to date	249,032 10	3.4,193 09	d 75,166 19

Northern Central Railway, Shamokin Division.

Below is the return of Coal sent over the Shamokin Division of the N. C. R. W., for the 7 days ending June 20, 1873.

	Tons.	Cwt.
East	1,322 13	
West	12,095 02	
		13,417 15
Same time last year		13,985 11
Increase		.....
Decrease		567 11
Total amount shipped to date		261,157 00
Same time last year		231,768 02
Increase		29,388 18
Decrease		

Penn. and N. Y. R. R.—Coxton, Pa.

Coal tonnage for week ending June 21, 1873.

	Week. Tons.	Cwt.	Total. Tons.	Cwt.
Anthracite received:				
From Lehigh Valley R. R.	11,362 16		218,197 06	
" Lack. & B. R. R.	329 12		16,192 10	
" Pleasant Valley R. R.	2,207 12		90,195 02	
" Sul. & Erie R. R.	648 00		19,596 15	
Total	14 487 10		344,183 13	
Same time last year	10,125 19		308,340 15	
Increase	4,361 11		35,842 18	
Decrease				
Distributed:				
To Lehigh Valley R. R.	116 04		20,468 16	
To Lack. & B. R. R.	58 12		633 18	
To S. Central R. R.	3,378 06		82,017 19	
To Ithaca & A. R. R.	4,173 15		53.760 11	
To Erie R. W. Pockets for shipm't.	5,469 02		121,683 07	
To individuals on line of road	105 11		17,377 09	
To points at & above Coxton for use of Co.	281 10		14,811 12	
To points between Waverley and Elmira	504 10		33,430 01	
Total	14,487 10		344,183 13	
Bituminous received from BARCLAY R. R.				
Shipped north from Towanda	6,834 07		155,963 13	
Shipped south from Towanda	96 00		1,072 08	
Northern Central R. R.	....		45 14	
Total	6,930 07		157,081 15	
Same time last year	8,920 16		184,777 09	
Increase	.....		.....	
Decrease	1,989 09		27,695 14	
Distributed:				
To Erie Railway	6,503 04		131,881 12	
To So. Central R. R.	326 03		18,892 16	
To Ithaca Valley R. R.	....		149 08	
Lehigh Valley, R. R.	91 00		556 10	
To individuals on line of Railroad.	10 00		483 05	
To points on line of road for use of Company	....		118 04	
Total	6,930 07		157,081 15	
Grand totals transported				
Anthracite	14,487 10		344,183 13	
Bituminous	6,930 07		157,081 15	
Total	21,417 17		501,265 08	
Same time last year	19.046 15		493,118 04	
Increase	2,371 02		8,147 04	
Decrease	.....			

Report of Coal Transported over the Lehigh Canal

For the week ending June 20, 1873.

REGIONS SHIPPED FROM.	TIDE tons. cwt.	LOCAL tons. cwt.	TL. WEEK tons cwt.	TL. DATE tons, cwt.
Mauch Chunk Region	3,795 19	3,785 11	7,581 10	71,8·3 12
Mauch Chunk Region Hazardville	889 18	189 17	1,079 15	1,079 15
Beaver Meadow Region	676 10	3,394 18	4,071 08	36,764 07
Mahanoy Region	296 07	1,022 19	1,318 06	4,905 15
Hazleton Region	2,022 07	5,761 17	7,787 04	69,··· 07
Upper Lehigh Region	181 00	935 04	1 116 04	9,993 02
Wyoming Region	1,6·3 12	1,089 01	2,712 13	38,337 07
Wyoming Region, Hazardville				
Total	9,·94 13	16,187 07	25,697 00	232,400 05
Previously reported	77,184 00	129849 05	206,733 05	
Total to date	86,668 13	145731 12	232,400 05	
Corresponding week last year	92,870 04	150678 11	243,548 15	
Increase				
Decrease	6,201 11	4,946 19	11,148 10	

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR. 1873.	YEAR. 1872.
Consumed on line of Lehigh Canal	2,691 00	3,168 14	23,115 07	26,766 18
Passed into Morris Canal to Tidal Points	129 18	402 14	848 13	1,696 10
Passed into Morris Canal to Local Points	339 16	942 08	3,961 10	6,513 10
Passed into Del. & Rar. Canal to Tidal Points	9,314 15	11,236 18	85,320 09	91,273 14
Passed into Del. & Rar. Canal to Local Points	717 14	670 19	4,447 13	6,254 06
Consumed on line Delaware Div. Canal	1,429 16	2,156 03	11,249 10	15,498 16
Passed through to Bristol	10,965 01	9,596 15	97 967 12	95,645 01
	25,967 00	28 144 06	232 400 05	243,549 15

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, June 21, 1873.

	WEEK.	SEASON.
By Delaware and Hudson Canal	45,983	463,739
By Railroad, East	9,955	185 615
" West	11,311	215,202
" South	1,001	124,394
Total 1873	68,250	988,950
Corresponding time in 1872:		
By Delaware and Hudson Canal	47,869	437,771
By Railroad, East	11,594	314,842
" West	7,944	167,663
" South	6,783	269,029
Total	73,990	1,089,305
Decrease	100,355	

Delaware Lackawanna & Western Rail Road Company.

Coal transported on the Delaware, Lackawanna, & Western Railroad for the week ending Saturday, June 21, 1873.

	WEEK. Tons. Cwt.	YEAR. Tons. Cwt.
Shipped North	20,616 03	351 892 10
Shipped South	47,784 04	1,088,450 10
Total	68,400 07	1,440,343 00
For the Corresponding time last Year:		
Shipped North	15,429 05	311,255 13
Shipped South	40,687 10	1,024,406 16
Total	56,116 15	1,335,661 09
Increase	12,283 12	104,681 11
Decrease	.....	

Report of Coal Transported over Lehigh Valley Railroad

Report of coal tonnage for the week ending June 21, 1873, with totals to date, compared with same time last year.

WHERE SHIPPED FROM.	WEEK. Tons. Cwt.	TOTAL Tons. Cwt.
Total Wyoming	15,968 09	428,600 03
" Hazleton	54,517 15	1,096,278 00
" Upper Lehigh	52 03	1,968 17
" Beaver Meadow	12,971 16	347,259 03
" Mahanoy	13,804 11	229,642 13
" Mauch Chunk	. . .	2,263 19
Total	95,314 00	2,096,012 05
Same time last year	80,960 12	2,040,902 08
Increase	14,351 08	55,109 17
Decrease	.....	.....
Forwarded East from Mauch Chunk by rail	70,035 08	1,670,315 14
Same time last year	58,607 13	1,686,185 09
Increase	11,427 15	.....
Decrease	.....	14,280 05

DISTRIBUTED AS FOLLOWS.

Local East of Mauch Chunk	720 12	43,431 00
Forwarded East for use L. V. R.	1,088 07	33,251 02
Delivered to Furnaces and Manufacturing Companies	12,215 03	389,957 02
Delivered to Cat & Fog R. R.	93 17	3,322 07
" " East Penn R. R.	71 08	6,104 18
" " North Pennsylvania Railroad	5 202 03	173,763 10
" " Port Del	5,232 11	76,429 03
" " East Amboy Railroad	6 05	5 75
" " Morris and Essex Railroad	6,183 12	158,592 17
" " Bel Del Railroad	23,234 14	486,5-6 15
" " Central Railroad	15,738 01	301,837 00
Delivered at and above Mauch Chunk for use of L. V. R.R.	1,400 18	38,456 04
To P. & N. Y. R. R.	11,302 06	218,197 06
To North-rn Central R. R.	539 01	9,061 05
To D. H. & W. R. R.	727 02	19,016 00
To L. & S. R. R. at Packerton for rail	284 13	7,136 08
To Individuals at Mauch Chunk	10 18	1,721 17
To Individuals above Mauch Chunk	165 00	8 713 14
To L. &S. R. R., at Penn Hav., for railroad		1 541 10
Do. for canal	7,787 04	69,967 17
To Lehigh Canal Mauch Chunk	3,031 05	22,191 05
To Catawissa Railroad		50 00
To L. & B. R.R. at Lack. June	31 08	29,920 19
Total	95,315 00	2,096,012 05

Report of Coal Transported over Central R.R. of N. J. (Lehigh and Susq. Div.)

Week ending June 21—Compared with same time last year

REGION SHIPPED FROM.	TIDE. tons ct.	LOCAL. tons ct.	CANAL. tons ct.	TL WEEK tons cwt.	TL. DATE tons.cwt.
Wyoming	21413 13	5566 16	2091 09	29677 18	8509:9 17
Upper Lehigh		2291 5	1013 01	4079 16	94654 07
Beaver Meadow	3516 02	1692 09	2989 13	6098 04	106 936 11
Hazleton		504 0)	7644 10	7951 19	75310 15
Mauch Chunk	1867 08	3546 01	7633 06	13046 15	233841 13
Total	26803 03	14110 10	21870 15	62784 12	1,361671 03
Prev'ly reported	621348 15	486648 16	190899 00	1298836 11	
Total to date	648151 18	500749 06	212769 15	1361671 03	
Same time .1872	549675 13	371294 13	150613 19	1071584 10	
Increase	98476 05	129454 08	62156 01	290086 13	
Decrease					

DISTRIBUTION.	WEEK 1873.	WEEK 1872.	YEAR 1873	YEAR 1872.
Forwarded East by Rail to Tidal points	26803 03	19305 03	648151 18	549675 13
Forwarded East by Rail to Local points	6391 11	10170 02	211805 05	174528 06
Forwarded East by Rail use Central Division	1832 02	1416 14	42806 17	38677 02
Forwarded East by Rail use L. & S.	205 10	103 09	6351 06	4126 12
Delivered at and above Mauch Chunk	1001 19	792 12	37150 07	25904 16
Delivered at Coalport & Hazard for Canal	22385 03	19233 08	242121 16	173606 05
Delivered to L. V. R. R. at Packerton	204 08	305 19	14470 19	7565 13
Delivered to L. V. R. Rd at Sugar Notch	1453 09		5 559 08	
Delivered to L. & B. R. R.at Plymouth Bridge	2235 07	3087 19	108146 09	99500 03
Total	62781 12	54335 03	1361671 03	1071584 10

Statement of Coal Transported over Cumberland and Pennsylvania Railroad

During the week ending Saturday June 21, and during the year 1873, compared with the corresponding period of 1872.

WEEK.

	C. & O. C'l Tons. Cwt	B. & O. R. R. Tons. Cwt.	Pa. S. Line Tons. Cwt	Total. Tons. Cwt.
1873	22,982 02	28,683 18	1,296 05	52,964 05
1872	20,140 13	26,247 04	....	46,387 17
Increase	2,841 09	2,436 14	1,296 05	6,576 08
Decrease	.....	.....	....	....

YEAR.

1873	241,778 11	646,801 01	41,136 01	929,715 13
1872	251,945 17	575,775 11	....	826,821 08
Increase		71,025 10	41,136 01	102,894 05
Decrease	9,267 06	....	....	...

Cumberland Branch R. R.

WEEK.

	To C. & O. Canal. Tons. Cwt.	To B. & O. R. R. Co Tons. Cwt.	Total. Tons. Cwt.
1873	4,243 02	1,861 11	6,0 4 13
1872	6,498 06	509 10	7,007 16
Increase	—	1,352 01	.....
Decrease	2,255 04	.....	923 03

YEAR.

1873	37,796 06	54,574 18	92,321 04
1872	80,438 10	7,966 13	88,405 03
Increase		46,558 05	3,916 01
Dec ease	42,642 04		

Delaware and Hudson Canal Company.

Coal mined and forwarded by the Delaware and Hudson Canal Company for the week ending Saturday, June 21, 1873.

	WEEK.	SEASON
North	64,746 13	1,231,280 12
South	1,000 15	124,394 08
Total 1873	65,747 08	1 355,675 00
Corresponding time in 1872:		
North	53,753 09	1,214,625 06
South	6,183 03	169,029 09
Total. 1872	60,536 12	1,383,654 15
Increase North	10,993 04	16,655 06
Decrease North		
Increase South		
Decrease South	5,782 08	44,635 01
Increase	5,210 16	.....
Decrease	.....	27,979 15

Prices of Coal by the Cargo.

(CORRECTED WEEKLY.)

	AT NEW YORK. June 27.		AT PHILADELPHIA. June 27.	
SCHUYLKILL.	R. A.	W. A	R. A.	W. A.
Lump	$— —	$5 45	— —	4 10
Steamer	— —	5 45	— —	4 10
Broken	5 70	5 45	4 35	4 10
Egg	5 85	5 60	4 50	4 25
Stove	6 05	5 75	4 70	4 40
Chestnut	5 20	5 95	3 85	3 60
Pea	— —	— —	— —	— —
LEHIGH.				
Freight to New York 50 cents.				
Lump, (on board)	— —	5 60	— —	— —
Broken	— —	5 30	— —	— —
Egg	— —	5 30	— —	— —
Stove	— —	5 45	— —	— —
Chestnut	— —	4 75	— —	— —
Pea	— —	— —	— —	— —
SPECIAL COALS *				
Honey Brook, Le'h W. A.	4 70@5 60		— —	— —
Spring Mountain " "	5 60@— —		— —	— —
Sugar Loaf " "	5 70@— —		— —	— —
Room Run " "	4 70@5 55		— —	— —
Hill & Harris " "	4 70@5 60		— —	— —
Shamokin " "	4 70@5 40		— —	— —
Lykens Valley " "	4 85@6 10		— —	— —
Broad Top " "	6 60@— 10		5 35	— —

Company Coals.

June, 1873.

	L.	Str.	Grs.	Eg.	Sto.	Chest
*Scranton at E. Port	4 35	4 35	4 55	4 75	5 60	4 35
Pittston at Weehawken	4 80	4 80	4 80	5 00	5 50	4 70
*Lackawana at Weehawken	4 70	4 70	4 90	5 15	5 60	4 70
Wilk'b're at Hoboken	4 65	4 75	4 90	5 00	5 20	4 65
Old Co. Lehigh at Pt. John'n	5 60	—	5 30	5 45	5 50	4 80
New York Coal Exchange	5 45	—	5 20	5 30	5 45	4 75

For freights to different points see "Freights."
*To contractors only.

Prices at Baltimore—June, 1873.

Wholesale Prices to Trade.

Wilkesbarre, by cargo or car load	$5 75@6 00
Pittston and Plymouth, do	5 50@5 75
Shamokin Red or White Ash, do	5 50@5 75
*Lykens Valley Red Ash, do	@5 80
By retail, all kinds per ton of 2,240 lbs	7 50@8 00
*George's Creek and Cumberland f. o. b. at Locust Point for cargoes	@5 00
Fairmont and Clarksburg gas f. o. b. at L. Point	6 50
Kanawha Cannel, coarse	@12 00

* Freight to New York $2 15.

BITUMINOUS COALS.

Kittaning Coal Co.'s Phœnix Vein, f. o. b. at Phila	$
Lemon " " "	
Cumberland Vein Coal	
Tyrconnel f. o. b.	$7 00

Prices at Georgetown, D.C., and Alexandria, Va.

June, 1873.

George's Creek and Cumberland f. o. b. for shipping $5 00@— —

Prices at Havre de Grace, Md.

June, 1873.

Wilkesbarre and other White Ash for Cargoes	$ @....
Lykens Valley	@....
Shamokin Red or White Ash	....

Bituminous Coals (Cumberland).

Georgetown, F. o. b.	$4 60
Baltimore "	5 00
New York "	7 25
South Amboy "	7 50

Prices of Foreign Coals.

June, 1873.

Duty 75 c. per ton.

Corrected weekly by ALFRED PARMELE, No. 32 Pine street, N. Y.

Liverpool Gas Coking	— —@— —
" Cannel	17 00@— —
" House	20 00@22 00
" Orrel	20 00@— —

Per ton 2,240 lbs., ex-ship.

PRICES FROM YARD.

Liverpool House Orrel, screened	$20 00@22 00
"Cannel, "	17 00@ ...

Per ton 2,000 lbs. delivered.

Prices of Gas Coals.

June, 1873.

PROVINCIAL.

Corrected weekly by Louis J. Bolioni, Jr., 41-43 Pine st., N. Y

	Coarse	Slack
Block House	$2 50	$1 25
Gowrie	2 00	0 00

Corrected by Bird, Perkins & Job, 27 South street.

	Coarse.	Culm of Coal,
Picton	$3 00	1 50
Sydney	3 25	1 00
Lingan	2 75	1 00
Caledonia	2 75	1 25

A discount from the prices of the coarse Coal on purchase of 5000 tons and upwards. Duty on all slack coal or Culm: 40c. per ton of 28 bushels, 80 pounds to the bushel. On all bituminous coal or shale: 75 cents per ton of 28 bushels.

AMERICAN.		Nominal quo Currency.
Westmoreland	f. o. b.	$6 00 @7 00
Fairmount Gas Coal Co. of N. Y.	"	6 50 @7 00
Despard Coal Co	"	6 50 @7 00
Penn	"	6 50 @7 00
Newburg Orrel Gas	"	6 50 @7 00
West Fairmount Gas Coal	"	6 50 @7 00
Redbank Cannel, at Pa	"	12 00 @0 00
AT PHILADELPHIA.		
Westmoreland	"	7 50 @0 00

Foreign and Provincial Freight

June, 1873.

Foreign.

Newcastle and Ports on Tyne, per keel of 21 1-5 tons £
Liverpool, 5 per cent primage

TO NEW YORK.

Provincial

Sydney	$3 75
Lingan	4 00
Cow Bay	4 00
Port Caledonia	4 00
Little Glace Bay	4 00

TO BOSTON.

Sydney	3 50
Lingan	3 60
Cow Bay	3 50
Port Caledonia	3 50
Little Glace Bay	3 50

TO MONTREAL.

Caledonia	3 75 gold.

TO CUBA.

Caledonia	6 50 gold.

Freights.—June, 1873

TO EASTERN PORTS.	Cumberland. From Georgetown.	Cumberland. From Baltimore	Anthracite. From Philada.	Anthracite. From Bds. Pt., Jersey Pt., Johnson, Weehawken, and Hoboken.	Anthracite. From Newburgh.	Anthracite. From Rondout.
Amesbury	3 75	—		—	—	—
Bangor	3 25	—		2 10	—	—
Bath	3 10	3 00		2 20	—	—
Boston	3 00	3 00		2 00*	—	—
Bridgeport	2 50	3 00		1 00	—	1 00
Bristol	—	—		1 50	1 55	1 65
Cohasset Narrows	3 10	—		—	—	—
Derby	3 00	—		1 75†	—	—
Dighton	2 65	—		1 45	—	—
East Cambridge	2 75	—		2 05	—	—
Fall River	2 50	2 75		1 40	1 60	1 70
Hackensack	—	—		—	—	—
Hartford	3 10	3 25		1 50	1 65	1 75
Hoboken	2 15	—		50	—	65
Jersey City	2 15	—		50	—	65
Lynn	—	—		—	—	—
Middletown	—	—		1 10	—	—
Mystic	—	—		1 30	—	—
New Bedford	2 70	2 85		1 50	—	1 75
Newburyport	3 25	3 25		2 25	—	—
New Haven	2 50	2 50		1 00	1 20	1 25
New London	2 50	2 65		1 25	1 40	1 45
Newport	2 65	—		1 40	1 60	1 65
New York	2 25	2 15		50	—	65
Norwalk	2 75	2 50		1 00	—	1 25
Norwich	2 65	2 75		1 35	1 60	1 55
Pawtucket	1 10	3 00		1 50‡	—	1 80
Portland	3 00	3 00		2 00	—	—
Portsmouth, N. H	3 10	3 25		2 15	—	—
Providence	2 00	2 7		1 40	1 60	1 75
Rockport	—	—		—	—	—
Saco	—	—		—	—	—
Sag Harbor	—	—		1 30	—	—
Salem	—	3 25		2 10	—	—
Stamford	—	—		1 00	1 20	1 45
Stonington	—	—		1 25	—	1 55
Taunton	—	—		1 90	—	—
Warren	—	—		1 40	—	—
TO RIVER PORTS						55
Albany	3 50					50
Catskill	—					50
Cocksackie	—					65
Coeymans	—					20
Cold Spring	—					40
Fishkill	—					40
Haverstraw	—					65
Hudson	2 50					45
New York vessels	2 00					30
Nyack	—					30
Poughkeepsie	2 40					—
Rhinebeck	—					40
Rondout	—					50
Saugerties	—					55
Sing Sing	—					80
Staatsburgh	—					60
Tarrytown	—					20
Troy	—					50
West Point	—					
Yonkers	—					

† 3 c. per ton per bridge extra.
† New Haven rate and towing 25 c. extra per ton.
‡ Towing from Providence and return, extra.
§ And towing.

St. Thomas	$ — — Gold
Martinique	— — "
Demerara	— — "
New Orleans	— — "
Mobile	— — "

Rates of Transportation to Tide Water.

BY RAILROAD.

TO PORT RICHMOND, PHILADELPHIA.

Philadelphia and Reading Railroad, from Schuylkill Haven Lump and St., net, $1 60; Br., Egg and Ch., $1 65; Stove, $1 75
Shipping at Pt. R., 23c., for use at Phil., $2 18 from Pt. Carbon.

MAUCH CHUNK TO ELIZABETHPORT.

L. V. Railroad from Mauch Chunk to Phillipsburgh	$0 72
C. R. R., N. J., Phillipsburgh to Elizabethport	06
Shipping expenses at Elizabethport	25
Wharfage	10
Total	$2 23

MAUCH CHUNK TO PORT JOHNSTON.

L. V. R.R., or L. & S. R.R. from M. C. to Phillipsb'g	$0 72
C. R. R., of N. J., Phillipsburgh to Pt. Johnson	1 06
Shipping expenses	25
Wharfage	10
Total	$2 23

TO HOBOKEN

L. V. R. R., Mauch Chunk to Phillipsburgh	72
Morris & Essex R. R. Phillipsburgh to Hoboken	1 06
Shipping expenses	25
Wharfage	00
Total	$2 23

TO SOUTH AMBOY.	
L. V. R. R.	72
B. & D. R. R. / Cam. & Am R. R.	1
Shipping Expenses,	55
Total	$2 23

PENN HAVEN TO ELIZABETHPORT.	
L. V. R R Penn Haven to Phillipsburgh	84
C. RR. of N. J. Phillipsburgh to Elizabethport	1 06
Shipping expenses	15
Wharfage	20
Total	$2 35

MARKET REVIEW.

NEW YORK, June 26, 1873.

IRON—The market continues in the same dull state as noticed for several weeks past, and but little inquiry is looked for until after the warm days have passed. We quote Eglinton $43@$44, and Glengarnock $45@$46—of the latter brand very few if any outside lots are now offering, and the market is somewhat firmer; we note sales of 350 tons Eglinton, 300 do. Glengarnock, and 200 do. Carnbroe on terms withheld. American Pig partakes of the general dulness, and prices are not strong; as a rule the best No. 1 brands cannot be had below $50 (which price the companies are generally asking), while outside parcels are offering for less money; we only hear sales of a few small parcels at full figures. New English Rails are quiet, and may be quoted $67@$70 gold, with a sale 1500 tons at a price not made public. New American may quoted $77@$80 at the works in Pennsylvania. In old English, we hear of nothing doing. Scrap is nominally $45@$48 from yard; 500 tons just arrived was sold previously at a price we did not learn. Refined Bar from store continues dull and weak, and we reduce our quotations generally, about $2.50 per ton. The difference in favor of American Refined Bar as compared with the cost of England laid down, is at least $16 per ton. There are some Swedes in store, and some of the leading sizes are now obtainable at our quotations

LEAD—The full supply of Domestic Pig offering has rather a depressing effect on Foreign, and prices are rather in buyers' favor; at the more favorable prices there has been a larger business, and the sales foot up about 500 tons at 6¼@6½ cents for Domestic, and 6⅝@6¾ for Foreign; 25 tons Spanish brought $6.70, all gold. Bar 9¼ cents, Sheet and Pipe 10½, and Tin-lined Pipe 16½, less 10 per cent. to the Trade.

Withdrawals from bond for consumption 20th, 21st, and 23rd June—

Pig Lead, Spain.....pigs.420

COPPER—New Sheathing is steady at 38 cents, and Bolts and Braziers 40; Bronze and Yellow Metal Sheathing 27, and Y. M. Bolts 32, net cash. Ingot is dull, and prices still recede; sales have been made of about 100,000 lb. Lake at 28⅛@28¾ cents, and in a small way 29. English is entirely nominal, with but little here.

SPELTER—Is dull, and we have only to notice sales of 10 tons Silesian at 7¼ cents gold; and 20 do. American (Western) 8⅛ currency.

REGULUS ANTIMONY—There have been some arrivals, but we have heard of no sales. It may be quoted nominally at 14½ cents gold.

STEEL—Is steady and firm at our quotations. We stated the fact some time since, that orders in Shefield for this country, had been countermanded, and placed here. On this subject, the Sheffield *Telegraph* says:

"THE STEEL TRADE—We are informed by one of the leading firms in the Steel trade that within the last few days letters have been received from the United States countermanding a large number of orders on account of the high prices which now prevail. These orders are being placed in America, and both manufacturers and workmen in England are likely to feel the effects of the grasping policy which has been recently pursued by too many coal owners as well as by the best paid artisans. The result of that policy has been an advance of price which is quite as prejudicial to the interests of this country as are the heavy protective duties on other side of the Atlantic—of which we have all been complaining so loudly. The increase of our exports of Iron and Steel has recently been at a diminishing rate, and it is high time that the question how far we are driving trade from the country should be carefully considered by mine owners as well as by workmen."

TIN—Cables have been received from London advising a further advance in Pig—English now £140@£141; from Singapore the telegraphic quotation is $35.25 per picul. These accounts have imparted more life to the market as well as strengthened it, and there has been considerable business, say about 2800@3000 slabs at 30⅛@31½ cents, now held at 31½@32; and about 120 tons English, mostly on orders, but including 30 tons on the spot and to arrive, at 30@30½, now held at 31 and scarce; Banca nominally 36½@37, all gold. The market for plates has been active, and, with stocks much reduced, holders are very firm at our quotations; the jobbing demand is also much better; sales have been made of 1500 bxs. Charcoal Tin at $11.25 @11.50 for I. C.; 250 do. ½ X and Extras, $11.37½; 500 do. I. C. Coke Tin, $9.12½; 300 do. $9.25; 1750 do. Charcoal Terne, $10.12½@$10.25; 2500 do., last week, $10.12½; 500 do. to go West, $10.12½; 1000 do. Coke Terne, $8.62½; 1500 do., $8 75, all gold; 500 do. Charcoal Terne, 500 do. Coke Tin, and 500 do. Coke Wasters, on private terms, closing at $11.50@$11.75 for Charcoal Tin, $9.25@$10 for Coke Tin, $10.50@$1075 for Charcoal Terne, and $8.75@$9 for Coke Terne, gold.

Withdrawals from bond for consumption 20th, 21st and 23rd June—

Tin, from England.....bxs.849

ZINC—Sheet is unchanged. Manganese black 3½ cents, do. gray 6 cents.

METALS.

NEW YORK, June 26, 1873.

IRON.—Duty: Bars, 1 to 1¼ cents ℔ lb; Railroad, 70 cents ℔ 10 lbs.; Boiler and Plate, 1½ cents ℔ lb; Sheet, Hand, Hoop, and Scroll, 1¼ to 1¾ cents ℔ lb; Pig, $7 ℔ ton; Polished Sheet, 3 cts. ℔ lb; Galvanized 2½; Scrap Cast, $6; Scrap Wrought, $8 per ton. All less 10 per cent. No Bar Iron to pay a less duty than 35 per cent. ad val.

	Store Prices,
Pig, Scotch—Coltness ℔ ton	54 00@—
Gartsherrie	—@53 00
Glengarnock	45 00@46 00
Eglinton	44 00@—
Pig, American, No. 1	47 00@50 00
Pig, American, No. 2	44 00@45 00
Pig, American, Forge	38 to 40 00
Bar Refined, English and American	60 00@—
Bar Swedes, assorted sizes gold	—@137 50

	Store Prices, cash.
Bar, Swedes, 1⅛ to 5 x ⅜ & ⅞ 2 sq. & 6 to 12 x ⅜ & ½	175 00@180 00
Bar, Refined, ¾ to 2 in. rd. & sq. 1 to 6 in. x ⅛ to 1 in.	92 50@ 95 00
Bar, Refined, 1¼ to 6 by ¼	97 50@100 00
Bar, Refined, 2⅜ to 2⅞ round 1 & 1¼ by ¼ & 5:16	100 00@102 50
Large Rounds	104 50@117 50
Scroll	112 50@145 00
Ovals and half-round	120 00@140 00
Sand	110 00@112 50
Horse Shoe	—@122 50
Rods, ¼ to 3-16inch	97 10@140 00
Hoop	1.0 00@170 00
Nailrod	9¼@ 9¾
Sheet, Russia, as to assortment (gold)	16¼@ 18
Sheet, Singles, D. and T. Common	—6¼@— 7¼
Sheet, D. and T. Charcoal	—7¼@— 8¾
Sheet, Galv'd, list 10 per cent, discount	—@— —
Rails, English (gold), ℔ ton	67 00@ 70 00
Rails, American, at Works in Pennsylvania, currency	77 50@ 80 00

COPPER.—Duty: Pig, Bar, and Ingot, 5; Sold Copper 4 cents ℔ lb; Manufactured, 45 per cent. ad val.

	All Cash.
Copper, New Sheathing, ℔ lb	—@— 38
Copper Bolts	—@— 40
Copper Braziers, 16oz. and over	—@— 40
Copper Nails	—@— 45
Copper, Old Sheathing, &c. mixed lots	27 @— 29
Copper, Old, for chemical purposes, 14@16 oz.	—@— —
Copper, American Ingot	24¼@— 28¾
Copper English Pig	—@— —
Yellow Metal, New Sheathing & Bronze	—@— 27
Yellow Metal Bolts	—@— 32
Yellow Metal Nails, Sheathing and Slat'g	27 @— 30

LEAD.—Duty: Pig, $2 ℔ 100 lbs.; old Lead, 1¼ cents ℔ lb Pipe and Sheet, 2¾ cents ℔ lb.

Galena, ℔ 100 lbs	$6 50	@6 62½
Spanish (gold)	6 50	@6 62½
German, do.	6 62½	@6 75
English do.	6 75	@7 00
Domestic do.	6 25	@6 37½
Foreign, Refined	7 37½	@7 50
Bar (net)	9 25	@—
Pipe (net)	——	@10 50
Sheet	——	@10 50

STEEL.—Duty: Bars and ingots, valued at 7 cents ℔ lb or under 2¼ cents; over 7 cents and not above 11, 3 cents ℔ lb; over 11 cents, 3½ cents ℔ lb. and 10 ℔ cent ad val. Store prices.

English Cast (2d and 1st quality) ℔ lb	—	18½@— 23
English Spring (2d and 1st quality)	—	9½@— 10½
English Blister (2d and 1st quality)	—	14 @— 18½
English Machinery	—	14½@— —
English German (2d an 1st quality)	—	12½@— 14½
American Blister "Black Diamond"	——	@— 11½
American, Cast, Tool do.	——	@— 17
American, Spring, do.	——	@— 11
American Machinery do.	—	11½@— 12
American German, do	—	9 @— —

TIN.—Duty: Pig, Bars, and Blocks, 15 ℔ cent. ad val.; Plate and Sheets and Terne Plates, 25 ℔ cent.; Roofing 25. ad val.

	Gold ℔ lb.
Banca	36¾@37
Straits	31⅝@34
English	30½@31

PLATES.

Fair to Good Brands.	Gold.	Currency
I. C. Charcoal, ℔ box	$11 25 @11 75	$13 25 @13 75
I. C. Coke	9 25 @10 00	11 00 @11 75
Coke Terne	8 75 @9 00	10 50 @10 75
Charcoal Terne	10 50 @10 75	12 25 @12 50

SPELTER—Duty: In Pigs, Bars & Plates, $1.50 p. 100lb

Plates, Foreign	(gold) p. 100 lb.	7 6¼@— 7 87½
Plates, Domestic	p lb.	8½@—11

ZINC—Duty: Pig or Block, $1.50 per 100 lb.; Sheet 2½c per lb

Sheet	per lb.—10½@10¾

San Francisco Stock Market.

BY TELEGRAPH.

NEW YORK, June 27, 1873.

Our report from the San Francisco Stock Board is dated the 24th inst. Excepting a slight decline in Gould and Eureka G. V., the market evinces a decidedly firmer feeling than noticed in our last, Savage and Belcher figuring most prominently, the former being $15 and the latter $11 higher than per last report. Following is the list:

	June 24.		
Savage	139	—	—
Crown Point	112	—	—
Yellow Jacket	64	—	—
Kentuck, "New Issue"	11	—	—
Chollar Potosi	51	—	—
Gould & Curry "New Issue"	12	—	—
Belcher "New Issue"	97	—	—
Imperial	6	—	—
Raymond & Ely	6⅛	—	—
Meadow Valley	21½	—	—
Eureka G. V.	—	—	—
Ophir	—	—	—
Hale and Norcross	—	—	—

American Institute of Mining Engineers.

OFFICIAL BULLETIN.

Announcements to Members and Associates.

I. The ENGINEERING AND MINING JOURNAL, which is the Organ of the Institute, and contains its proceedings, transactions and notices of meetings, will be sent to each Member and Associate on the payment of his annual dues. Back numbers cannot, as a rule, be sent.

II. Dues are payable in advance at the annual (May) meeting. Remittances should be made, as far as possible, by P. O. Order, payable to the Secretary.

III. The first volume of Transactions of the Institute is in course of preparation and will be sent, as soon as issued, to all members not in arrears.

IV. General meetings are held on the fourth Tuesday of February, May and October. Authors of papers are requested to notify the Secretary, in advance of meetings, of the subject and length of their papers.

THOMAS M. DROWN, Secretary.

1123 Girard street, Philadelphia, Pa.

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SEND FOR ILLUSTRATED CATALOGUE.

April 1:6m

TO INVENTORS AND MANUFACTURERS

The Managers of the 42d Exhibition of the American Institute, of the City of New York, beg to announce, that the Exhibition Buildings on 2d and 3d Avenues and 63d and 64th Streets, will be open for the reception of heavy Machinery August 18th and for other articles, September 1st 1873. The Exhibition will be formally opened September 10th.

For particulars, address "General Superintendent, American Institute, New York."

May 27-Sept. 10

THE ENGINEERING AND MINING JOURNAL.

ROSSITER W. RAYMOND, Ph. D.
JOHN A. CHURCH, E. M. Editors.

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THE SCIENTIFIC PUBLISHING COMPANY.
WILLIAM VENTZ, SECRETARY.
27 Park Place,
P. O. Box 4404. NEW YORK CITY.

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THE Mexicans are alarmed at losing the trade coinage of the East by the introduction of our new trade dollar. The Mexican Congress has voted to re-coin the old "Eagle" dollar in the hope of retaining the command of the Eastern coinage supply, a business that is worth to the Mexican government a million a year. Our own trade dollar is reported to take very well, and were the dies ready we could coin a great deal of money for foreign use.

THE Board of Commissioners to inquire into the causes of steam boiler explosions, has had a meeting for organization, in Washington. D. D. Smith, Supervising Inspector General of Steam vessels, was made Chairman, and George W. Taylor, of the Steam-boat Inspection Bureau of the Treasury Department, Secretary. Messrs. Copeland, Low and Menshaw, were appointed a committee for the East. Messrs. Holmes, Crawford and Denenny were appointed a committee for the West. These committees presented plans for trials, one series to be made at Sandy Hook and the other at Pittsburgh. A joint report was presented which defined the work of the commission as follows: "We should state that by the term explosion, as used in the report, we mean to imply those burstings of a very violent and destructive character, as distinguished from a mere opening or rupture of a weak part of the structure, which results in little or no damage other than to the boiler itself." The co-operation of persons interested in the subject is desired, and they may communicate with the chairman.

THE importation by an English firm of a thousand tons of manufactured iron from this country, while undoubtedly a very suggestive circumstance, has stirred up an amount of discussion, and has been treated in a style which the case will hardly warrant. The iron business of this country must first provide for its own necessities before it can think of exporting in any quantity, and to build works enough to cover the large margin between the demand and supply of iron in this country will require the investment of an amount of capital which must take years for its collection. Patience must still be the watchword of the American who desires to see his country self-supporting in the matter of metals. The trade correspondence of English papers shows that there is a deal of anxiety among the ironmasters of those districts which have for so long a time depended upon the United States for a market. Those gentlemen would be less nervous if they would read Mr. DUNLAP's last report to the Iron and Steel Association. He showed that the consumption of iron, exclusive of American scrap, was 3,654,618 tons, and of this no less than 1,254,618 tons was imported. He calculated that the 109 new furnaces built last year could not produce more than 327,000 tons, and the 39 others already decided upon for 1873 would, at the same rate, add only 117,000 tons to the production. Allowing 1872 and 1873 together an increase of 654,000 tons, we have still a margin of 600,000 tons of iron which must be imported, without considering the losses in transforming pig iron to bars. American ironmasters must therefore find capital to build the (say) 200 furnaces and the numerous rolling mills necessary to produce and work up this 600,000 tons, and that is not the work of one year. But until it is done, the United States cannot become exporters, except in very exceptional cases.

THE steamship GREAT EASTERN with a new telegraph cable on board is gradually drawing near the American shores, having by noon of June 26 paid out 1701 nautical miles of the line. She expected to reach Heart's Content, Newfoundland, on Saturday. The landing will be made in the harbor of Sidney, Cape Breton, and the smoothness of the ocean throughout the voyage is good promise that the termination will be a happy one. In fact the business of laying cables is now so well established that the risks of serious disaster are very small. There was, we believe, considerable comment made when this cable was projected, and there always is when a new line is proposed. People seem to think that three cables ought to be enough, but within the past few months two of those have been disabled, and it can hardly be doubted that increasing age will make them still more liable to injury or deterioration. It is probable that it will be necessary to lay a new cable at intervals of a very few years, in order to keep our telegraphic communication in perfect order.

Boiler Explosions.

WE are indebted to Mr. CHARLES COCHRANE for a very practical and valuable pamphlet,* describing the circumstances connected with 74 casualties to boilers or boiler fittings in England, in 1872. The pamphlet forms the semi-annual report of the Midland Boiler Assurance Company of England. The district in which the Midland Company operates is one that contains a very large number of blast furnaces and collieries, so that of the 3,285 boilers under inspection 1,155 were used at collieries or other mines, 1,502 at iron works, the remainder, 628, being set in mills of various kinds. It is worthy of notice that among this large number only two slight and one serious explosion occurred in the latter half of 1872, and none in the first half. We print in another place an extended extract from the report of the chief engineer, Mr. MARTEN, and will only say here that the report takes strong ground in favor of what may be called *special* causes of boiler explosion. That is to say, the engineer considers that the causes of explosions should be looked for in defects of construction, gradual deterioration of the boiler, or mismanagement, such as suffering the pressure to rise too high; and that those theories which seek in the sudden development of overpowering force, by the operation of causes which are still obsure, are unnecessary, however interesting. In a word, he thinks that boiler explosions arise from defects that may be remedied by inspection, and does not think that new physical laws must be developed by investigators before we can hope to understand the reasons why boilers explode. When the boiler is once rent other forces come into play which had nothing to do with its first rupture. For instance, the water in a steam boiler is at a temperature much above 212° on account of the pressure upon it. When that pressure is relieved the excess of heat converts a new portion of the water into steam, and does it almost instantly. When therefore a boiler shell ruptures, two forces are brought into play; 1st, the steam which rushes out and seeks the volume natural to it at the atmospheric pressure; 2nd, the steam resulting from the extra heat stored up in the water; and the destructive effect of these two forces is distributed over a still larger area by atmospheric impact. It may be said that this *material* explanation of boiler explosions is only natural in the engineer of a boiler insurance company. But his conclusions are certainly confirmed by the results of inspection both before and after explosions. The English records contain accurate information of more than 1,000 explosions in that country, and about as many in other countries, and it is an undoubted fact that the insurance system, with its accompanying inspection, has been of the greatest value in preventing explosions.

Another field of usefulness has also been developed by these companies. They encourage the indication of engines, and, as the first step in practising economy is to know the conditions under which we already work, it has been found that manufacturers have sometimes been able to make an important saving of fuel, simply by finding out what they had been ignorant of for years, that their engine or boilers, or both, were not working well. The high price of fuel in England will probably have a very decided influence in encouraging the intelligent management of steam machinery.

The subject of boiler explosions has especial importance to miners, metallurgists and railroad men, for it is to these three industries that more than half the boiler explosions are credited. Of 550 explosions, 134 were at mines and 95 at smelting works. The use of blast furnace gases as a means of heating has increased the danger at iron works in a very perceptible degree, the reasons for which are given fully in the report we copy elsewhere. The circumstances of the case make explosions peculiarly disastrous, in a financial point of view, at iron works and at mines, for the whole activity of the establishment must often cease when the boiler is disabled. In view of these circumstances we look to the managers of such works for the most vigorous encouragement of associations like that whose report we are considering.

Mr. MARTEN has collected in one volume† his reports of the years from 1866

* CHIEF ENGINEER'S REPORT to the Midland Steam Boiler Inspection and Assurance Company (Eng.) for 1872.

† Records of Steam Boiler Explosions by EDWARD BINDON MARTEN. London: E. & F. SPON.

to 1871 inclusive, forming a most valuable and authoritative record of the disasters from the use of steam, accompanied by illustrations showing the result of the principal explosions upon the boiler itself. He has prefaced the book with a paper on Steam Boiler Explosions and their Records, in which the explosions of 1,046 boilers are classified.

New Publications.

ROWELL'S AMERICAN NEWSPAPER DIRECTORY—Containing accurate lists of all the newspapers and periodicals published in the United States and Territories and the Dominion of Canada and the British Colonies of North America. New York, GEO. P. ROWELL & Co., 1873.

While this is a book *of* newspapers, it is *for* advertisers. It gives with great faithfulness the name, publisher, circulation and price of every periodical published on the North American Continent, and with a great number of the notices are given the cost of advertisements and details, descriptive of the paper's place in the world of business, or of literature. The remarkable thoroughness which the work has attained in so few years is a proof of the extent of its publishers' business. This year a very good history of American journalism, dealing minutely with the earliest American papers, is given; and in the preface the editor discusses the changes of the year in his peculiar field. The number of periodicals in the United States is 6,875, and in the British possessions and Canada 416—the increase in the States being 356, and in Canada 13. The details of this increase are by no means uninteresting. More than a fourth of it is made up of new daily papers, and it is a noteworthy fact that, while daily and weekly papers increase, the semi-weekly and bi-weekly do not; nor are bi-monthlies popular. The vallies of the Ohio and Mississippi rivers are this year, as they were last year, the principal fields of increase, and if the expectations of the American people are confirmed, this is likely to be the fact for years to come, in consequence of the rapid increase of population there. The prosperity of the country is, in fact, almost or quite as well indicated by the advance of journalism in its different sections as by any other sign. Nor is the improvement confined to numbers alone. Consolidation is constantly confirming the stability of newspapers, and the editor reports that the tendency of the past year has been much more toward improvement of those already in existence than even toward the founding of new enterprises.

THE RESOURCES of the Coal-field of the Upper Kanawha, with a Sketch of the Iron Belt of Virginia, by M. F. MAURY, jun. SHERWOOD & Co., Baltimore, Publishers.

In this pamphlet Professor MAURY has collected the known facts in regard to the immense and interesting mineral deposits of Virginia. In addition to the geology of the district much practical information upon the behavior of the fuels in the furnace, together with analyses, and mining information are given. The subjects of water power, timber, iron deposits and similar factors of industrial success are treated in a way to exhibit in a striking light the wonderful resources of this part of our country. Professor MAURY's pamphlet is undoubtedly devoted especially to furthering the reputation and prospects of the State in which he has his home, but though his may be partisan pleading, it is eloquence spent upon a cause that is fully worthy of it. Virginia is a magnificent State, and there are many in this commonwealth who would gladly see her ample coal and iron deposits receive they attention they deserve.

APPARATUS FOR ELECTRIC MEASUREMENT, with rules and directions for its practical application, by L. BRADLEY, Jersey City.

In this pamphlet Mr. BRADLEY describes an apparatus, of his own invention, for measuring the force of electric currents. In doing so he has produced a really useful and handy manual of telegraphic work so far as it is confined to measurements, tests, etc. The apparatus consists of a tangent galvanometer and rheostat, by using which faults and breaks can be located on telegraph lines and cables, the insulation resistance of telegraphs, the force of batteries, the conductivity of metals and other things can be determined with great accuracy. The pamphlet contains instruction in the mode of doing this, and also goes into more general matters, explaining the use of some telegraphic terms, and giving much useful information in formulas, tables and the like.

NICKEL, by Dr. LEWIS FEUCHTWANGER, New York.

This is the reprint of a lecture delivered before the Polytechnic Branch of the American Institute. It is meant to give an account of the history, sources and application in the arts of this latest and most brilliant addition to the metallic resources of mankind. Nickel coinage and nickel plating are treated of with the Doctor's characteristic attention to detail, and the pamphlet is perhaps as useful and complete a treatise upon the subject as it is possible to condense within so narrow bounds.

THE REPORT of the Board of Commissioners of the Third Cincinnati Industrial Exposition forms a pamphlet of 230 pages, and contains a detailed account of what is said to have been an exhibition of unusual success. Cincinnati has proved to be one of the most successful of all American cities in the conduct of its industrial exhibition, and this fact alone is sufficient to prove that there is something exceptionally vigorous either in its public spirit or in the management of its manufacturers.

ENGLISH CORRESPONDENCE.

LONDON, June 10, 1873.

TO THE EDITOR:

SIR—Notwithstanding the efforts made to suppress the feelings of alarm which really exist here in relation to the future of the iron trade in this country, still these feelings will at times crop out. Referring to the importation of American iron, which has made so much talk, the *Telegraph*, of London, says: "Should these reports be correct, and should the imported commodity equal in quality British produce, we are plainly beaten in a field considered almost peculiarly our own. The quality of the metal, of course, is a material element in the question. It is not enough that goods should be cheap—they must be sound. Cheapness alone will not give any foreign or home product a permanent place. We know nothing respecting the character of the low-priced American iron, which may be better than any that we manufacture. But, should it be only equal, British capitalists and workers have a stiff rivalry to encounter. If it pays to bring American strip iron and axles to England, how much more to carry them into France, Germany, and Russia! The reserves of ore in the States are practically unlimited, and the energy of our cousins in utilising every field opened up has passed into a proverb. Steam has now bound together the commercial and industrial markets of the world, and it is pretty plain that wider averages than formerly ruled will regulate prices, supplies, and profits. It is only to be hoped that rivalry so keen will stimulate invention, diminish the cost of processes, teach our workmen moderation in pressing their advantages, and so enable us to hold our ground."

From South Wales the correspondent of one of the papers reports that "there is some satisfaction in finding that the prospects of the iron trade are somewhat better than was apprehended. Buyers continue to limit purchases, because they think that if they can hold out a little longer they will turn quotations in their favor, and consequently there is not much new business doing; but in the meantime makers are content to make the most of the contracts in hand, feeling pretty confident that they will be able to keep the market up. The works are at present engaged on contracts on account of India, South America, and Europe. These will keep up activity for some time to come; but makers do not hasten operations, because it would not be advisable at present to turn out the largest supplies of iron possible. The holiday season has, therefore, come in conveniently, and the men are allowed to take as many holidays as they think fit. Important contracts are expected from the United States shortly, which will appreciably add to the activity of the trade. There might possibly be a slight fall in quotations ere long, and it will be rather favorable to makers than otherwise, as it will check the advancement in the cost of labor."

From Middlesbro', the reporter says: "There are symptoms springing up that the inflated prices of iron which have been ruling have had their legitimate effect in lessening the demand. There is an increasing difficulty with the finished iron makers to secure orders. Messrs. FOX, HEAD & Co., of the Newport Rolling Mills, have given their workmen notice that they will not be able to keep at work regularly, and other works are either in a similar position or have been laid off altogether. It is possible that trade may somewhat revive later on, but many hold the view that this can hardly be expected if the present high prices are still continued. Finished iron can hardly be reduced below its present level if the present rates for coal, coke, and pig iron are maintained. It is asserted by the iron manufacturers that they can barely work at a profit at present rates, considering the cost of material and the high prices of labor. Rails of ordinary sections are about £12 15s. to £13 5s., and other sorts of iron are proportionately high. Pig iron has this week been quoted at 115s. to 117s. 6d., but prices are very largely nominal, owing to the very few sales which are made. The effect of the depression on finished iron would appear to have, in a measure, communicated itself to pig iron, judging by the returns of the Cleveland Ironmasters' Association, which have just been issued, as, notwithstanding the lessened make of nearly 7,000 tons during the month of May, as compared with April, there was during the former month an increase of makers' stocks, showing that the demand for iron had largely fallen off. Compared with the corresponding month of 1872 there were 10,500 tons less of shipments during last month. Household coals of best quality command about 19s. to 20s. per ton at the pit's mouth; coke, 42s. 6d. to 45s."

It will be very gratifying to our American scientists to know that Prof. MAYER, of the "STEVENS," is being received here in a most appreciative and distinguished manner by the most eminent savants of England. Whenever opportunity offers he stands forth as a champion for American science, and has on several occasions, to my own knowledge, demonstrated that English scientific men have much to learn of us.

By the next steamer I hope to be able to tell you how some of the principal members of the Iron and Steel Institute receive the invitation which I learn has just been tendered by the American Institute of Mining Engineers. M.

Supplementary Paper on the Geology of the North Shore of Lake Superior.

By T. STERRY HUNT.*

IN my address on the Geognostical Relations of the Metals, delivered before the American Institute of Mining Engineers on the 20th of February last, and published in the ENGINEERING AND MINING JOURNAL of March 4, I spoke of the rocks in the vicinity of Thunder Bay, Lake Superior, where I indicated two series

* Read before the American Institute of Mining Engineers, at Philadelphia, May 21, 1873.

of uncrystalline rocks resting upon the Huronian schists, the lower one consisting of dark colored argillites and sandstones overlaid, apparently in slight discordance, by the nearly horizontal red and white sandstone and marls, which were compared with those of Sault Ste. Marie, and those of the Portage Lake district, on the south shore. These latter, according to BROOKS and PUMPELLY, overlie unconformably the Keweenaw series of copper-bearing amygdaloids and conglomerates, and are in turn overlaid by the Trenton limestone. I then proposed to call this lower series of Thunder Bay, the dark colored argillites and sandstones, which are traversed by the silver-bearing lodes of that region, the Animikie Group.

Shortly after the publication of that address I received an abstract of a paper on that region by Prof. ROBERT BELL, read before the Montreal Natural History Society, February 24. He there confirms the statement made in my address that the gold of Lake Shebandowan occurs in the Huronian, which is also seen to be cut by the silver-bearing lodes just mentioned. Prof. BELL, in this paper, proposes to designate both what I have called the Animikie and the overlying red and white sandstones, by the name of the Nipigon group, for the reason that this upper division is best displayed about Lake Nipigon. This latter is by LOGAN supposed to be overlaid by the copper-bearing amygdaloids with conglomerates and sandstones of the north shore (apparently identical with those of Keweenaw) and the whole together, including the Animikie group, constitute his upper copper-bearing group. These copper-bearing strata are by him supposed to be overlaid by the red and white sandstones of St. Mary, which are apparently the same with those sandstones which, according to BROOKS and PUMPELLY, overlie unconformably the similar cupriferous rocks of Portage Lake, and are, in their turn, overlaid by the Trenton limestone.

Thus the sandstones which at Thunder Cape overlie the Animikie group are by LOGAN placed in the midst of the copper-bearing series, and far below the paleozoic sandstones of the south shore. MACFARLANE, on the other hand, looks upon the two series of sandstones as identical, and at the same time ascribes to them a mesozoic age, which is inadmissible for the latter series. It is not here the time nor the place, to enter into a discussion of the vexed question thus presented; but I may here suggest in a few words as a probable solution, that the horizontal sandstones of Thunder Bay, whether identical with those of the south shore or not, and whether paleozoic or mesozoic, are really newer than the adjacent cupriferous amygdaloids, and are not to be confounded with the sandstone strata which on both sides of the lake are found interstratified with these as integral parts of the more ancient Keweenaw or copper-bearing series. Since, therefore, a difference of opinion exists as to the stratigraphical equivalence and the age of these horizontal sandstones of the north shore it is well to distinguish them by a local name, and that of the Nipigon group, proposed by Professor BELL, is very appropriate. It should, however, in my opinion, be confined to the upper region, and not include the grey sandstone and argillites to which I have given the name of the Animikie group, and which, so far as yet known, are not met with beneath the red sandstone of the south and east shores of Lake Superior.

Boiler Explosions and Inspection.

ABSTRACT FROM THE CHIEF ENGINEER'S REPORT OF THE MIDLAND STEAM BOILER INSPECTION AND ASSURANCE COMPANY.

GENTLEMEN:—I have the honor to report that up to December 31st, 1872, there were 3285 boilers under the care of the Company, and this number has since increased. There have been two slight and one serious explosion among the assured boilers during the past half-year, but without injury to any one. There was no explosion among the boilers under the Company in the first half of the year 1872. The first explosion was from the collapse of the tube of a Cornish boiler. A night watchman raised the fires earlier than usual, and the water was so far evaporated before the arrival of the regular attendant that the tube was overheated and gave way, but without moving the boiler or injuring the premises. The second explosion was one of the long plain cylinder boilers, used for burning the waste gases from blast furnaces. It rent at a seam-rip, caused by the peculiar strain on these boilers from their length, and the rapid changes of temperature with each variation of the quantity or quality of the gas. The damage done was considerable, but as the boilers were assured on the group principle, initiated by this Company, the whole amount was available on the explosion of one boiler, and went far towards the cost of reinstating. The third explosion was very like the first. A Lancashire boiler collapsed in one flue, and was injured in the other by overheating through shortness of water. An explosion, slight in itself, but unfortunately causing two deaths, happened to one boiler under inspection. An angle iron used to attach the two halves of the back end proved faulty, as a seam-rip was found where it was hidden from view, and it ruptured and allowed the contents to issue, but without moving the boiler or disturbing more than the brickwork behind it.

All these boilers were used at ironworks. For some time past nearly half the boiler explosions of the Kingdom have been at collieries or ironworks, and as the boilers under the Company are nearly all at such works, it may be inferred that their work lies among boilers subject to unusual vicissitudes, and of necessity in more exposed positions than boilers working in ordinary mills and manufactories.

With regard to construction or design, attention has been drawn to the most suitable form of boiler for using blast furnace gases, or the best means of working safely those long plain cylinder boilers ordinarily used for the purpose. The extreme length of these boilers causes the unequal expansion from the variable heat of the bottom, and the comparatively uniform cool top, to show itself in alternately lifting off the end or central supports, converting the boiler into a girder, at one time supported at the ends and loaded in the centre, or at another time supported at the centre and loaded at the ends. The strain thus produced is in addition to the injury caused by the rapid alterations of temperature when the gas is suddenly lighted or extinguished.

The effects of the lifting may be much mitigated by the volute springs or balanced supports adopted by Mr. HEAD, of Middlesbro, but the lifting itself would not take place if the long boilers were cut into two or more shorter lengths placed one beyond the other, and each supported at only two places. The objection sometimes made that this would necessitate double fittings would be met by simply connecting the separate compartments with a bent wrought iron pipe at the upper part, the feed pipe remaining on the back compartment and the steam pipes on the front. The feed would thus fill the back compartment and overflow into the forward part, any steam formed passing with the water. The water gauge would be needed on the front part only. This alteration necessitates only the dividing of the boiler, and in most cases no alteration at all to the fittings, while it would secure the advantages found in similar arrangements of plain cylinder boilers side by side with a continuous flue around them, that the water would deposit its scale and mud in the part furthest from the heat, and pass gradually on to the hottest place.

The necessity for making use of the blast furnace gases for raising steam, has forced those who fear the uncertainty of the long plain cylinder boilers to adopt novel forms of boiler. Two well-known forms of tube boilers have proved satisfactory for those using them, but newer works are being constructed with combinations of plain cylinders more like those just described. Considerable trouble has been found in various parts of the country from the too rigid staying of the ends of Cornish or Lancashire boilers preventing proper expansion of the tube and straining the seams.

The need of periodical inspection of boilers has been well exemplified in the frequent detection of internal or external corrosion, more especially in some of the boilers newly placed under the Company.

The number of boilers which exploded during 1872 was 58, killing 37, and injuring 114 persons, but, as in former years, the records include other explosions of the apparatus or fittings closely connected with boilers, bringing the number up to 74 explosions, causing 50 deaths, and 137 cases of injury. About half the number killed were either the owners, managers, or men directly responsible for the boilers. The greater part of the remainder were those employed about the works, and the few others were strangers or passers by. The largest number of explosions have taken place, as in former years, at collieries or ironworks, but with much less fatal results. The most fatal cases have been either in steam vessels, or at chemical works of various kinds. The causes of explosion have been, as heretofore, about equally divided between faults of construction, want of proper inspection, or inattention of attendants, but there has been an unusual number of casualities to steam pipes and fittings. Plain cylinder boilers, externally fired, and Cornish or Lancashire boilers, internally fired, have burst in about equal number. The explosions generally have confirmed the oft-repeated conviction, that no boiler, however good when new, is safe without periodical inspection.

E. B. MARTEN, Chief Engineer.

British Iron and Steel Association.

ON A NEW AND IMPROVED SYSTEM OF WIRE ROPE TRAMWAY.

By HENRY MARTIN MORRISON.

This system of tramway has been invented by Herr HERMANN MÜLLER, the director of Herr SIGL'S engineering works at Vienna. The object of the invention is the erection of a cheap, expeditious, and effective mode of transport, suitable for districts where the traffic would not pay for erecting a railroad on the usual plan. In this system the cars or other vehicles, are carried on two parallel endless wire ropes, passing at the terminal points over large driving and returning pulleys, and being supported and guided at certain distances by smaller pulleys. These guiding pulleys are fixed to, and carried by, vertical posts of wood or iron, carried to any reasonable height. The distance between these supports depends upon the nature of the ground as well as upon the weight to be carried, but spans of 300 and 400 feet are quite practicable. In many instances advantage may be taken of trees, or rocks, which may lie in the line of route. The motor, which may be a steam engine or water-wheel, only acts at one end of the line. The large pulleys at the driving end are both keyed on to one shaft, and are set in motion by the motor. These driving wheels, by the aid of the endless running ropes, communicate motion to the large pulleys at the returning end of the line, which pulleys are separately bedded, and run independent of each other, each having a tightening apparatus to prevent any unequal stretching of the ropes. These ropes also transfer the motion to the guide rollers. Any load to be transported, and consisting of vehicles, cars, trams, baskets, balks of timber, columns of iron, &c., &c., are made to rest upon the ropes with four claws or notches, in order to prevent slip and oscillation, and to enable them to follow the movement of the ropes while passing over the guide rollers. While two of the claws simultaneously set free the ropes, the two other claws keep the load upon the rope by friction. A system of disengaging claws attached to the tubs, and first used, was found expensive and complicated, and although retained as part of the patent, has now been superseded. A more simple method is now adopted, by which the claws are arranged to fall clear of the tubs, when not resting upon the ropes.

The large driving and returning pulleys are lined with wood, so as to increase the grip of the ropes, and avoid the wear consequent upon the ropes being driven on iron beds. The average diameter of the driving pulleys is 10 feet, unless a very high rate of speed is required, when they may be increased according to the requirements. It is not necessary that the pulleys and ropes be driven vertically, as, when the empty cars weigh over 5 cwt., the driving pulleys can be placed nearly horizontal, so that both ropes run parallel and next to each other in one direction, and the return ropes are placed in the same plane at the side of each other. It is not necessary that the terminal stations should be in the same plane, but any inclination may be given to the ropes up to 1 in 6, which may be worked with perfect ease. The wire ropes are four times the length of the distance to be traversed, and must be of the best material and workmanship, and most carefully laid. Steel wire rope is strongly recommended, as being better able to withstand the wear and tear consequent upon the necessary friction. Messrs. SCOTT are preparing to manufacture a special class of rope for this purpose, tempered and annealed by a special process, and having their own wire-drawing mill on the premises. Every care will be taken that all wires in the ropes will be of uniform temper. The carrying power of these lines range from 500 tons to 1,500 tons per day. Sharp curves may be passed by placing the motor at that point where the line is required to be deviated, as the shaft of the driving pulleys may be so placed, that the rope-way will form an obtuse angle. An arrangement of this kind, which is designated the coupled "traject" system, is most suitable for long lines, because by dividing the line into sections, the weight of, and strain upon, the ropes are very considerably diminished. The cars pass the junction without manual help, or without stopping, this being effected on the upper line of ropes by the momentum of the running car, and on the lower line by giving the rails the necessary inclination. At each end of the line a series of wood work, called "ramparts," are placed, to receive the cars from the running ropes, and also to enable the trams or cars to run on to the ropes without manual help. The cost of these lines averages from £1,000 to £1,500 per mile, but the difficulties to be overcome, and weight to be carried, tend very considerably to diminish or increase the cost. The advantages of this system may be briefly stated as follows: 1. It can act as a feeder or as a means of communication between narrow gauge railways, whose termini are intercepted by precipices, valleys, water, &c. 2. It avoids the expense of cuttings, embankments, bridges, &c. 3. Lines can be constructed as cheaply and efficiently in mountain districts as on plains. 4. They occupy scarcely any land, and may pass over rivers, houses, trees, &c. 5. They are not affected by flood or snow, and can readily be moved from place to place. 6. It can be employed in the carriage of coal, ironstone, and minerals of all kinds, having this advantage over other systems that the minerals need not be unloaded and reloaded, but taken away direct from pit or level mouth. 7. It is the most effective system for the carriage of slates, timber, beetroot, sugar, rice, coffee, cotton, and all kinds of plantation produce. 8. As passenger lines they offer a cheap and effective system of transport, having been used for that purpose. 9. It is most valuable as an accompaniment of an invading army. 10. Inundated land and broad lakes can also be passed over, and when the depth of the latter prevents the fixing of supports in the bottom, they can be fastened to anchored flats, with spans of 400 feet between each flat.

Engineering and Mechanical Notes.

EVIDENCE of the value of steel rails in a severe climate is afforded by the Great Western of Canada report. That company has already 154 miles of steel rails down, leaving 75 miles more to be laid with steel in place of iron. The Directors observe: "It will be seen that the effect of the use of steel rails is beginning to have a sensible influence upon the expenditure of this department." The cost of maintenance of way in the past half year is only £93,180, against £105,691 in the corresponding period of the previous year, although the traffic was larger and the trains more numerous. The percentage of the maintenance has fallen to 15.64 per cent. of the receipts, against 20.04 per cent.

The *British Colonist*, a Halifax (N. S.) paper, records a somewhat remarkable accident in the bursting of a solid and cold block of cast iron: "On Tuesday afternoon, while some workmen in Mr. JOHN HUNTER'S foundry, Sackville street, were engaged in breaking up a large block of cast iron, by the usual process, the mass burst with a loud report, one of the pieces striking one of the employees, a young man named Kennedy, causing serious internal injuries, from which he died yesterday morning. The deceased was one of the 'Kennedy' boat crew of four who recently rowed against and defeated four oarsmen from H. M. S. *Royal Alfred*." The only explanation that can be given is, that strains, occasioned by the unequal cooling of the mass, and already resident in it, were brought into action in the process of wedging the iron apart.

Foreign papers give an instance of a novel use of solar heat as a lever. During the recent building of a bridge in Holland one of the traverses, 465 feet long, was misplaced on the supports. It was an inch out of line, and the problem was how to move it. Experiment proved that the iron work expanded a small fraction of an inch for every degree of heat it received. It was noticed that the night and day temperature differed by about 25 degrees, and it was thought this might be made to move the bridge. In the morning the end out of place was bolted down securely, and the other end left free. In the heat of the sun the iron expanded, and towards night the free end was bolted down, and the opposite end was loosened. The contraction then dragged the whole thing the other way. For two days this experiment was repeated, till the desired place was reached. We find no record that the heat of the sun has ever been employed in this way before, but the contraction and expansion of iron bars by fire-heat has already been used to move heavy weights over short distances. Broken walls and strained roofs and arches have been brought into place by simply heating iron rods till they expanded, then taking up the slack by screws and nuts, and allowing contraction by cold to pull the wall or roof into place.

It is estimated that the number of railroad ties in present use in the United States are 150,000,000. A cut of 200 ties to the acre is above, rather than under, the average, and it therefore has required the product of 750,000 acres of well-timbered land to furnish the supply. Railroad ties last about five years; consequently 30,000,000 ties are used annually for repairs, taking the timber from 150,000 acres. The manufacture of rolling stock disposes of the entire yield of 350,000 acres, and a full supply of 500,000 acres more every year. It appears, then, that the railroads are stripping the country at the rate of 1,000,000 acres per annum; and their demands are rapidly increasing.

Mr. THOMAS JACKSON, ironmaster, of Coats' Iron Works, Coatbridge, England, and Mr. THOMAS SOUTHAN, ironworks manager, of the same place, have taken out a patent for "applying titanic iron ore in making and repairing bottoms of heating and re-heating furnaces in place of sand, in order to utilize the cinder from such furnaces for fettling puddling furnaces," a novelty which those who have used Canadian titanic magnetites for that purpose will appreciate.

The government of New Zealand, in the hope of encouraging a home production of iron from the titaniferous and other ores of the country, has offered the following incentives to enterprise, with a view to encourage certain colonial industries: A bonus of $25,000 for the production of 1,000 tons weight of pig iron of marketable quality; a bonus of $5,000 for the production of 100 tons weight of marketable steel from magnetic or titaniferous iron sand or iron ore. In addition to these prizes, others for the encouragement of manufactures have been offered, including a bonus of $10,000 for the production of 250 tons of sugar, manufactured from beet-root in New Zealand; a bonus of $12,500 for the production of 100 tons of printing-paper, manufactured in New Zealand by machinery, and a bonus of $1 per hundred to be paid on cured fish, dry or pickled, exported from the colony for consumption abroad. The Australian authorities have followed with great success this system of money payments, to the founders of industries and to the discoverers of new mining fields. There can be no doubt that the wonderfully rapid development of the country and the solid permanence of its prosperity, have been materially aided by this means.

Railroad Accidents in May.

THE *Railroad Gazette* reports that in May there were 51 derailments, 21 collisions, and 7 other accidents on American railroads. Two of the derailments were from obstructions maliciously placed and another from the explosion of powder maliciously placed on the track. Twenty-three of the accidents caused death or injury to persons, but of the 113 persons killed or injured 68 suffered in the two accidents at Soixante, on the Grand Trunk, and at Mt. Carmel, on the Louisville Air Line roads. The *Gazette* says: "There are some notable features in this month's report, among which is the reduction in the number of accidents by broken rails, only one being reported against 18 in December, 41 in January, 25 in February, 19 in March, and 7 in April. There was an unusually large number of accidents caused by runaway cars and trains, most of them being cars which broke from the rear of trains while ascending steep grades. No less than eight of the collisions as well as three of the derailments were caused by such runaways, five of which were owing to the breaking of couplings. Misplaced switches have also been an unusually frequent source of accident, having been the occasion of two collisions and seven derailments. As usual in summer, cattle on the track have been a serious source of accident, and some of the most serious are chargeable to this cause. For the twelve months ending with May our record was as follows:

	No. of Accidents.	Killed.	Injured.
June, 1872	44	63	114
July	31	35	66
August	63	15	49
September	71	24	104
October	90	29	102
November	103	37	114
December	112	42	133
January, 1873	178	40	199
February	133	25	126
March	112	18	92
April	101	23	88
May	79	10	113
Totals	1,117	361	1,300

The average number of accidents which we have reported in 1873 was 5.74 in January, 4.75 in February, 3.61 in March, 3.37 in April and 2.55 in May. The special lessons taught by the May report seem to be: better couplings, better care of switches, better fences and cattle guards; the general lessons taught by all these reports being vigilance, discipline and the most careful maintenance of road and rolling stock."

"Railroad murder" or the malicious placing of obstructions on the track is a feature of criminal activity which suddenly assumed unusual proportions during the past year, and the present month of June appears to be unusually rich in this peculiarly outrageous kind of crime. Many reports have appeared in daily papers of obstructions placed on roads, and we are happy to add that the pursuit of the perpetrators has been more than usually successful.

MINING SUMMARY.

California.

A MINING CAMP WITHOUT CAPITAL.—THE SAN DIEGO MINES.

From the *Mining* and *Scientific Press* of June 7.

We have the somewhat unusual instance to record where a quartz camp has, without a single cent of capital, been developed by the energy and perseverence of a few determined men until it has come to be recognized as one of the most prosperous ones of California. We allude to the mines of San Diego County, in Julian and Banner Districts, about 60 miles from the city of San Diego. They were first discovered in February, 1870; and although there was an "excitement" in the first instance, it rapidly subsided on account of the prejudice existing among most Californians against the "lower country," and particularly the county in which these mines are situated. Even now, very little seems to be known concerning them outside of the county, and people generally have thought that the accounts in the local papers were exaggerated. We will endeavor to show by a few all-potent, and at the same time reliable, figures, that there is more in these mines than is generally supposed. There are two districts in which the principal mines are located, Julian and Banner. The foundation is slate, sparsely interspersed with granite, and the veins run north-east and south-west. The veins are unusually numerous, though as a general thing, small. The auriferous belt is about four miles wide and ten long. The first ledge struck was the Washington, February 22, 1870. It was rich in gold at the surface, but is not now being worked. A number of other mines were discovered and a small Wilson steam stamp custom mill put up. The camp, however, languished until two very green miners (as usual) who knew nothing about the business, struck a ledge in San Felipe Cañon, while hunting for wild grapes. When this became known the canyon was thoroughly prospected and a number of rich claims located. The majority of them were exceedingly rich in gold and none were worked but such as showed free gold. A new mining district was formed and called

BANNER DISTRICT.

The canyon in which they are situated is called San Felipe, and the creek of the same name is over 1,400 feet lower than Julian City, though only two miles distant. The canyon runs into the great Colorado Desert in ten or twelve miles from the mines.

The principal mines are the Golden Chariot, Madden, Antelope, Kentuck, Ready Relief, Pacific, Aguadiente, Mogul, Montezuma, Chapparal, Ophir, Hidden Treasure, Romeo, Atlantic Cable, Redman, Hubbard, Poor Man, City of Richmond, Last Chance, Buena Vista, Blue Lead, Trail, and a number of extensions of the Golden Chariot. Several of these mines paid well on the surface, but did not on sinking. Others are now being worked and are paying well. The Redman, the first one discovered in the canyon, is a very large vein, and at one time was thought to be the "king ledge" of the camp. Inexperience in mining operations and financial difficulty has caused it to be temporarily idle. The Ready Relief, next adjoining the Redman on the south and owned by the BAILEY BROTHERS, is in a peculiarly favorable situation for working. They have four good levels running into the side of the mountain, from all of which good ore is being taken. A fine stream of water has been utilized to run a 3-stamp mill, by an over-shot wheel. Ten tons of ore from this ledge some time since yielded $980. A friend of ours, from there since the writer's visit, states that the mine is now turning out beautifully. The vein is five feet wide, and the ore averages $90 per ton. A shaft is now being sunk on the mine. It is owned by five men. A mill in the canyon some time since took 100 tons of ore from this mine, and after crushing twenty tons, discovered that it would not pay for crushing; whereupon the owners, thinking differently, crushed the rest in an arastra and got out $60 per ton.

The extension of this mine is owned by Mr. HUBBARD. He has a 5-stamp mill, run by water, and is making money. The ore from the Kentuck, in this canyon, paid about $40 per ton. From the Antelope, now idle, selected rock has paid $4 per pound. Some idea of its richness may be formed from the fact that the owners pounded out enough gold with a mortar and spring-pole to build an arastra, and with both mortar and arastra got enough to build a 5-stamp mill, engine and all complete, in a few months.

THE GOLDEN CHARIOT MINE is the banner mine of Banner District. It was found by G. V. KING, in February, 1871, and has proven itself to be the most productive mine in the "lower country." The main ledge was 2 feet wide at a depth of 20 feet. The shaft is now down probably 175 feet. A crushing of the rock some time since yielded $23,090, or $230 per ton. The ore from the upper levels pays about $190, and from the lower levels about $200 per ton. In one drift they had 14 feet of pay ore. One run of 50 tons crushed last October, yielded $8100 at the mill, or $160 per ton; 52 tons crushed in August paid $13,621, or $257 per ton. The ledge is now quite wide, and is paying at mill $100 per ton. When first opened the rock was packed to mill on mules; and since they have erected their own mill—a 5-stamp one—the waste rock sorted at that time, is now milling $100 per ton. They have some 500 tons of this rock on their dump, and are getting out more. The wagon road built to their mill lately, cost them $1800. This mine is one of great promise, and bids fair to rival many in older and more prominent mining districts. It has paid all its expenses from the period of its discovery, and a very handsome profit besides. One of the owners—the discoverer—sold out his interest to his partners, last January, for $25,000.

There are four quartz mills in this district: One Wilson steam stamp battery, belonging to Mr. WHITNEY, of this city, now in charge of Mr. BEGON; the Golden Chariot 5-stamp mill, run by steam; and two water-power mills, one with three and the other with five stamps. They are all wet crushers, and with one exception have copper plates and no pans, settlers, concentrators or arastras. Charges for milling are from $7 to $8 per ton.

JULIAN DISTRICT.

The prominent mines in Julian District are the Owens, Helvetia, Good Hope, Van Wert, Hayden, Big Blue, Great Eastern, etc. The representative mine of the district is the Owens, which has been incorporated, but is owned by a few parties. It has been more systematically worked than any of the other mines, and has paid large dividends for the past ten months. The shaft, when last heard from, was down 275 feet, and levels have been run at 100 feet from the surface, in ore that paid $20 per ton at mill. Several levels at a depth of 200 feet were in ore in both sides which milled $35 per ton. The third level, at a depth of 275 feet, goes east 260 feet and west 200 feet in ore that milled from $50 to $60 per ton. Thirty-two and a half tons worked some time since, paid $40, and ore in considerable quantity has been milled yielding $75 per ton. During a period of eight months in succession the sum of $42,319,50 was taken from 920 tons of ore, with 12 men at work. The rock averaged right through $26.55 per ton at mill. One run of 109 tons turned out $8,878,28, and 48 tons worked paid $3,987.40. The ledge is about 3 feet wide. It is owned by six men, and some idea of the value of the lode may be had from the following summary of operations for the last eight months:

920 tons of ore yielded	$42 319 50
Expenses of Extracting milling, etc	24,210 25
Net Proceeds for 6 owners in 6 months	$18,109 40

This paid each owner $3,036. A fine set of hoisting works is now on the mine, the first shipped to that part of the county except a small set on the Stonewall Jackson mine at the Cuyamaca Mountain. The ledge has been five feet wide, but at present writing is two feet wide at bottom of shaft.

The Helvetia mine has also paid its expenses from the start and has developed itself. The shaft is down upwards of 225 feet, the ledge averaging about 2½ feet; the rock averages about $30 per ton. The vein is now full three feet wide. A crushing from this mine is made nearly every month and $30 realized at the mill. A few weeks since a new vein was found at the bottom of the shaft in a place where they never had found ore before.

The Van Wert mine, owned by DE FREES, MOORE and TAYLOR has a tunnel now in 200 feet. The ore averages $50 per ton at mill. This mine was once abandoned after a long tunnel had been run, but these parties extended the tunnel some twenty feet and struck a rich deposit of ore.

The Washigton, once the "boss mine," and the first discovered in San Diego County, is being worked on a small scale only; a crushing recently turned out $40 per ton.

In the Hayden mine, they are down 250 feet; quite a large pile of good rock on the dump. They are taking out a good quality of ore.

The Excelsior belonging to the Count DWARAKOWSKY and HARVER, has a vein 2 feet wide at a depth of 40 feet. The result of a recent crushing was $33 per ton.

The Great Eastern, a segregation of the Excelsior, is being worked, and pays $20 per ton at mill.

The San Diego mine cleaned up from a recent crushing $31 per ton. The Blue Lead, near the Helvetia, is turning out well.

The Stonewall Jackson mine, belonging to FRARY and FARLEY, is about eight miles south-east of Julian City, in an isolated position in the Cuyamaca mountains. A fine ten-stamp mill and hoisting works are in operation at the mine. The mine is being worked systematically and has been well developed. The ledge matter runs from 12 to 16 feet in width. The mill is run by a 40 horse power engine. The lead has been in some instances 20 feet wide and yields from $12 to $20 per ton, all through.

QUARTZ MILLS.—The mill of the Stonewall Jackson numbers 10 stamps; that of DE FREES & Co., at Julian, 10 stamps; REYNOLDS & Co.'s mill at Julian, 5 stamps; WHITNEY'S patent steam stamp mill in the canyon has 2 stamps; that of the Golden Chariot in the canyon has 5 stamps; the Ready Relief mill, 3 stamps; Hubberd's mill, 5 stamps; and Wilson's steam stamp near Julian has two stamps. Mr. WILSON has rigged his mill so as to saw wood when out of rock. Fire wood sells in the district at $5 per cord. Lumber costs 16 cents per foot.

Idaho.

From the Owyhee *Avalanche* of June 14.

We visited the principal mines on War Eagle Mountain last Thursday, and are exceedingly well pleased with the result of our observations. After gliding down shafts, descending winzes, clambering through stopes and meandering through levels, we are able to arrive at but one conclusion, viz: that the present prospects of our camp are far brighter than at any time since its discovery. Indeed, we have never seen so many of our mines looking so well at one time as they do now, and we feel no hesitancy in predicting that our bullion product this season will exceed by, at least, one hundred per cent. that of any previous season in the history of Owyhee. This promising condition of affairs comes from the fact that the Mahogany, South Chariot, Minnesota, Golden Chariot and Red Jacket are all looking better than ever. Aside from these a number of new mines are being prospected with flattering results. Our mills are all running and will not be able to work the amount of ore that will be taken out this season. We have waited long and patiently for the present prosperous out-look, and it has come at last.

MAHOGANY.—Preparations are being made to sink a winze for the 8th level, 220 feet south of the main shaft. A new and exceedingly rich body of ore has recently been struck in the 7th level drift, 264 feet south of the shaft. The vein is from 2½ to 3 feet wide, and, this week, an assay of the ore (not selected with reference to its special richness) yielded $366 in gold and $806 in silver per ton or a total of 1,172 per ton—and the beauty of it is that there is plenty of the same quality in sight. This rich body of ore was first struck in the 6th level, and everything indicates that it will be found richer and more extensive than ever the deeper it is worked. Colonel P. H. OWENS, the Superintendent, has put up 5 tons of the rich ore in sacks which he will send to San Francisco in order that the "boys" may see and judge for themselves. The ore is a black sulphuret intermixed with pure native silver and fine gold in abundance. At no previous time has the Mahogany looked so well, and it may now be regarded as a first class and permanent mine. Ten stamps of the Ellmore mill commenced running on Mahogany ore last Tuesday, and they have over 600 tons ready for hauling and crushing.

MINNESOTA.—This mine is developing gloriously. The main shaft is down for the 6th level, which takes it to a depth of 536 feet. The 6th level is being run both north and south, having cut a very rich 2-foot vein in the latter direction. A winze from the 5th to the 6th level, 26 feet north of the shaft, is down all the way on the vein which is from 3 to 4 feet thick. The 5th level drift is in 225 feet south and 285 feet north, showing a very rich 3-foot vein throughout. The 4th level drift is in 208 feet south and 370 feet north, also showing very rich ore from 6 inches to 3 feet in width. Superintendent COFFIN thinks that the Minnesota is the "biggest mine on the mountain;" and it certainly is remarkably rich and extensive, as we are confident that future bullion shipments will demonstrate. The ore-house has been enlarged and everything is in tip-top order. A force of 90 men are now employed in the mine, and the Owyhee mill is running on the ore.

GOLDEN CHARIOT.—It now transpires that a rich and extensive body of ore has been

developed in the 6th level of this mine, commencing at the winze, 200 feet south of the main shaft and continuing further south for a distance of 150 feet. The ledge varies in width from 15 inches to 2½ feet, and shows pure gold and silver in abundance—decidedly richer than that which the mine yielded in the palmy days of '68. The ledge is well defined and immensely rich throughout, it being estimated that considerable of the ore will pay from $500 to $2,000 per ton. The daily yield is now about 12 tons, which will be largely increased as soon as the level shall be properly opened. The main shaft is down to the 9th level, a depth of 780 feet. A 70-foot winze from the 6th to the 7th level connects with the 7th level drift 200 feet south of the shaft. An 80-foot winze, 200 feet south of the shaft has also been completed from the 7th to the 8th level. The 8th level drift south is now in 210 feet. Both the 7th and the 8th levels are yielding good milling ore. Superintendent LINKTON is justly very proud of the appearance of his mine.

RED JACKET.—The adit level is now in 600 feet, being within 250 feet of the north shaft where a very rich shute of ore is known to exist. Work has been resumed on the north shaft preparatory to making the connection with the adit level. The incline winze is down 90 feet, and the west cross-cut from the lower level is in 90 feet in a southwesterly direction, showing a ledge from 4 to 7 ft. wide of ore that does one good to look at. The southwest cross-cut from the adit level is in 20 feet showing splendid ore in the face of the drift. The lucky owners of the Red Jacket have a big thing. Besides being rich and extensive, the mine possesses unequalled facilities for working. The character of the ore and the manner in which it is found deposited differs materially from that of any other mine in camp. Much of the ore is decomposed, and a pan of it taken out at random yields from 50 cents to $1 50 in gold. The South Chariot mill started up last Wednesday on Red Jacket ore, and works like a charm. The ore, house is full, the dump heaped up, and plenty of ore is seen everywhere about the premises. No assessment has been levied, an immense amount of work has been done in opening up the mine, and the present crushing will more than pay up all the indebtedness of the concern.

SOUTH CHARIOT.—After many months of patient and faithful prospecting, Superintendent MILLER has, at length, had his industry rewarded by striking a fine ledge in the 6th level, 340 feet north of the shaft. The new strike is from 3 to 4 feet in width of quartz that will most likely mill from $40 to $60 per ton. The main shaft is 510 feet deep, and the 3d level north is in 300 feet. Present developments indicate that the South Chariot will prove a big mine, as it is undoubtedly on the same mineral zone as Minnesota and Golden Chariot.

EMPIRE.—This mine is *in statu quo*. As will be seen by reference to another column the sale of delinquent stock has been postponed till the 28th inst. We regard the Empire as one of the best mines in camp. It is well opened, has splendid steam hoisting works, and it really seems too bad that those in authority do not effect some arrangement for working it.

ILLINOIS CENTRAL:—Yielding a fine quality of ore which is being worked at the arrastras, formerly owned by HAY & HUMPHREY, but now the property of the SANDS Bros. The boys are jubilant over their prospects and will make plenty of money this season.

IDA ELLMORE.—Superintendent WILLARD is now busily engaged in putting in his new steam pump, which will be ready for operation in a few days. When that is done we shall make it our special business to "interview" the Ellmore.

WAR EAGLE.—A company of miners are taking ore from this mine and having it worked at the Cosmos mill, with prospects of paying well.

IDLEWILD.—THOMPSON & Co. are now taking splendid looking ore from this mine, and will doubtless realize handsomely from it this summer.

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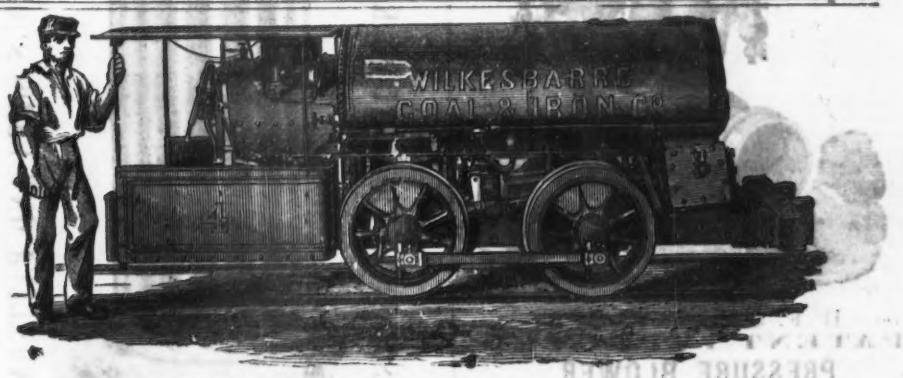

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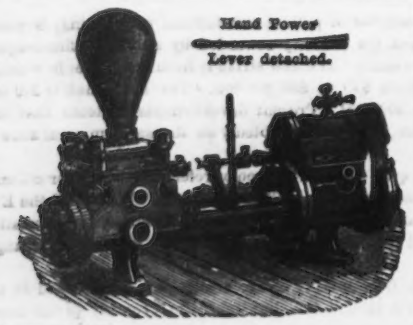

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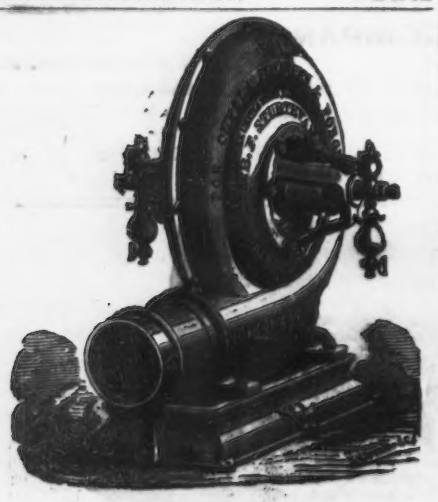

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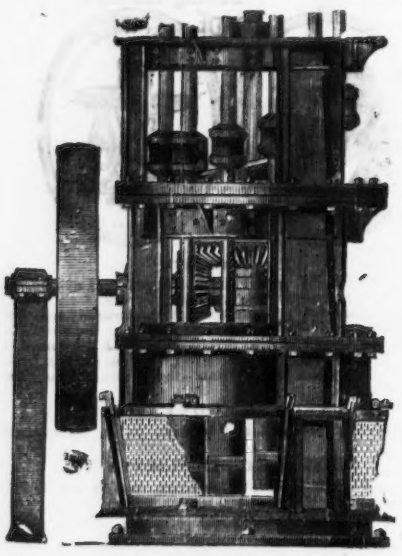

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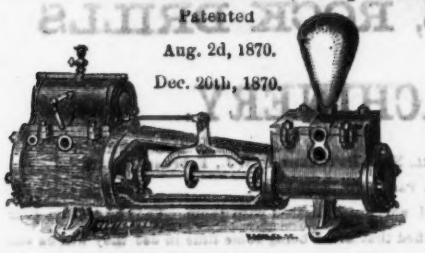
Dec. 20th, 1870.



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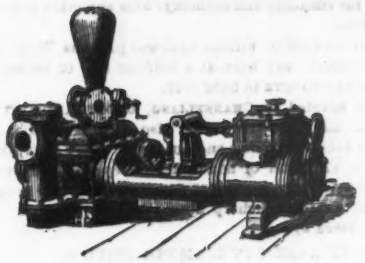

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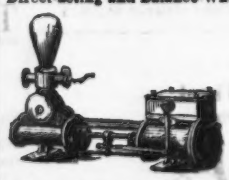
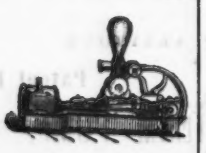

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